

FIRST LESSONS IN
HAND AND EYE TRAINING
FOR BOYS AND GIRLS

BY GUSTAV KALB

TRANSLATED AND ADAPTED FOR ENGLISH USE

BY

W. G. FIELD, M.A.

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FIRST LESSONS IN MANUAL WORK

FIRST LESSONS
IN
HAND AND EYE TRAINING
OR MANUAL WORK

For Boys and Girls

WITH ILLUSTRATIONS INSERTED IN THE TEXT

ARRANGED FOR HOME AND SCHOOL

BY

GUSTAV KALB
OF THE LEIPZIG LEHRERBILDUNGSANSTALT

TRANSLATED AND ADAPTED FOR ENGLISH USE

BY

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PREFACE.



THE attempt made by the present writer in 1889, to develop a system of practical training, based on Fröbel's but extended to meet the requirements of a boy up to the end of his tenth year, was cordially received, and has enjoyed an unusual degree of popularity. A considerable number of institutions for the young have adopted my little work as a text-book, and even our public schools have in many places made experiments with the occupations I proposed and explained. In the discharge of my duties as a teacher of manual dexterity I have had ample opportunities of gaining increased experience and discovering new forms of employment. I am accordingly now able to offer an enlarged scheme of occupations, of a kind which, I trust, will prove effective in kindling interest and stimulating activity.

At the same time, I desire to point out how these occupations can be directed to intellectual and moral ends; how through them, simple as they seem, we may draw out intuitions, inculcate knowledge, expand natural aptitudes, strengthen the wills and mould the characters of our children. And these results we seek to achieve by a method suited to the nature and inclinations of a child; not by mere instruction, but by calling into play that impulse to activity of body and mind which is innate in man.

The size of my book and the multiplicity of its contents render it inevitable that much must be simply indicated; the user will have no difficulty in elaborating the details for

himself. References to the literature of the subject and other assistance of a valuable kind will be found in Dr. Götze's *Handbook of Manual Training*, of which an English version has recently been issued by the publishers of this volume.

I commend my booklet to mothers, schoolmasters, and all who are concerned in the education of the young. It is intended for their guidance; their own judgment will enable them to select such parts of the matter as are suitable to the special gifts and dispositions of their pupils, to introduce changes and amplifications, and to foster in countless ways the inventive faculties and the energy of the little workmen whom it is their pleasant task to control.

GUSTAV KALB.

GERA, *March* 1893.

[Herr Kalb's book has been freely translated, somewhat expanded, and adapted to the requirements of English readers. This edition contains much additional matter supplied by the author, especially new designs for cutting out and moulding, and an introduction to chip-carving. I trust that it may find favour in the home no less than in the school, and that the reader will set down its demerits to the translator rather than to one who has gained his spurs in the cause of Manual Training.

W. G. F.]

INTRODUCTION.

IN the present day there is no difficulty in finding for boys of from two to six years of age employment at once useful and adapted to their intellectual development. Toys of wood, cardboard, metal, or stone are yearly turned out in abundance to meet their wants. Though care in selection is necessary, the supply of pictures and story-books is endless. Most useful of all for children at this stage are the Gifts devised by Friedrich Fröbel for the Kindergarten. These Gifts are usually divided into six groups:—

1. The ball of worsted.

[Six worsted balls, contained in a box. Three are of the elementary colours: one, red; one, yellow; one, blue. The others are of mixed colours: one, green; one, violet; one, orange.]

2. Wooden ball, cylinder, and cube.

3. The first building-box.

[A two-inch cube divided once each way into eight one-inch cubes.]

4. The second building-box.

[A two-inch cube divided by one vertical and three horizontal cuts into eight blocks.]

5. The third building-box.

[A three-inch cube divided twice in every direction, so as to give twenty-seven one-inch cubes.]

6. The fourth building-box.

[A three-inch cube divided into twenty-seven blocks.]

After these six Gifts come, in Fröbel's system, various form-exercises, in which *form* is considered in a wider sense. Such exercises are—

Tablet-laying.

Stick-laying (called also lath-laying).

Ring-laying.

Folding.

Weaving or braiding.

Pricking or perforating.

Embroidering.

Checker-drawing.

Cutting out.

Intertwining.

Interlacing slats (called also lath-plaiting).

Cork and pea work.

Modelling in clay.

Not a few of these occupations¹ can only be pursued in the Kindergarten, that is to say, up to a child's sixth year, in a very elementary manner. Elaborated, they become an excessive tax upon immature powers. Most of the form-exercises belong to a later stage of development, and cannot be practised with understanding and profit before attendance at the school proper has begun. Perforating, embroidering, and checker-drawing have disadvantages which are generally admitted, and these may perhaps be eliminated from the list of occupations for children. At the same time, the objections raised to them have less force in England than in Germany, where danger to the eyes is an important factor in every

¹ It is not relevant here to lay stress on the difference between the Gifts and the occupations. But see *The Education of Man*, by Friedrich Fröbel, translated by W. N. Hailmann, p. 287 (Appleton & Co., New York, 1889).

question of this kind. For all children of from six to eight years of age, tablet-laying, stick-laying, ring-laying, the production of simple forms by plaiting, the interlacing of slats, cork and pea work, and moulding with clay or plastilina will be found interesting, practically useful, and, if wisely governed, of high educational value.

My aim, then, is to bring the tasks of the school into close connection with those of the Kindergarten: the latter are in part repeated, and in part extended. As soon as the child has completed its eighth year it is required to fashion the various parts of its work for itself by means of simple tools, adapted to its strength and capacity. Understanding the parts, it learns to understand the whole, and it must also learn to resolve the whole into its parts. Analysis and synthesis go hand in hand.

Of late years many books and series of designs have appeared for boys above the age of ten; and in school workshops, technical schools, homes for boys, and so forth, very gratifying results have been obtained. But a bridge was needed between the Kindergarten and the school proper, or between the Kindergarten and all institutions in which Manual Training has been cultivated. I have endeavoured to build this bridge. Taking as a basis Fröbel's principles, I have erected a structure which, I hope, will be of permanent interest and value.

As the years pass, much that is new appears, to employ, entertain and instruct our boys. It has been found impossible to notice all that has been written. I have been compelled to restrict myself to what is most important, to exclude mere trifling, and to obey the sovereign rule of progress: *Vom Leichten zum Schweren*, from the easy to the more difficult.

G. K.

OUTLINE OF A SCHEME OF WORK

FOR BOYS OF VARIOUS AGES.



I. Age—six to seven. First school-year.

Form or shape laying with given forms. In representing number we do not go beyond ten.

1. Building (Fröbel's third and fourth Gifts).
2. Tablet-laying.
3. Stick-laying.
4. Ring-laying.
5. Interlacing slats.
6. Weaving or braiding.
7. Folding.
8. Modelling or moulding.
9. Combined occupations and their application in the school.

II. Age—seven to eight. Second school-year.

Form-laying and the fashioning of forms.

A. Without tools. B. With the aid of the scissors.

1. Building with Fröbel's building-boxes (Gifts 5 and 6), and with other boxes of bricks.
2. Stick-laying and tablet-laying.
3. Interlacing slats (more than ten).

4. Weaving or braiding of combined patterns, and intertwining.
5. Folding and mounting.
6. Moulding in plastilina.
7. Cork and pea work.
8. Cutting out and mounting.
9. Remarks upon the ways of conducting the different kinds of work mentioned, in the house or in the school.

III. Age—eight to eleven. Third, fourth, and fifth school-years.

Form-laying continued. The fashioning of new forms with the aid of tools.

1. Building with large brick-boxes.
2. Moulding in clay or plastilina.
3. Weaving, folding, and mounting; cutting out and mounting.
4. The making of small ornaments for the Christmas tree, etc.
5. Cardboard-work.
6. Work with thin *wood-pulp*.
7. Wood-work, executed with the knife. (Use of the pocket-knife.)
8. Wood-work, executed with help of knife, hammer, brad-awl, etc.
9. Use of the fret-saw for simple work.
10. Supplementary exercises in cutting out.
11. " " in modelling.
12. Introduction to chip-carving.

FIRST LESSONS IN MANUAL WORK.



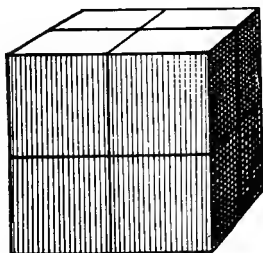
I.

Age—six to seven. First school-year.

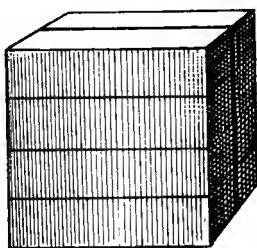
FORM OR SHAPE LAYING WITH GIVEN FORMS.

I. BUILDING (FRÖBEL'S THIRD AND FOURTH GIFTS).

THE third Gift, or first building-box (see Fig. 1), is a cube of 2 inches, divided by three cuts into eight 1-inch cubes; the fourth Gift, or second building-box (see Fig. 2), contains



1.



2.

a cube divided by means of one vertical and three horizontal cuts into eight blocks. If we add to the first building-box two 1-inch cubes, and to the second two blocks of the same size as those already contained in it, we

have material enough to engage the attention of boys during their first school-year, and to develop their ideas of number between the limits of one and ten.

Moreover, by means of these cubes and blocks we can produce a variety of forms illustrative of the world of life and beauty, and calculated to draw forth a child's sense of form, its impulse towards activity, and its imitative faculty (Figs. 3-19).

The following rules may be given for the use of the little workman :—

1. Begin with the cube, and, when you have ended your play, build the cube up again.

[What is a cube? How does it differ from a ball and from a cylinder? What is the edge of a cube?]

2. Use all your bricks for whatever you build.

[Examine always the qualities of what you have built. See what effect is produced by taking away one brick.]

3. Make one building out of another; never pull down, but add to what you have made.

4. Combine the bricks in the first building-box with those in the second, and invent new shapes for yourself.

[Remember that all may be apprentices, all may endeavour to learn. He who has learned and can do something is the journeyman. The master craftsman is he who can design and invent for himself.]

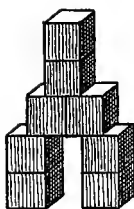
2. TABLET-LAYING.

Tablets may be made of wood, coloured and polished, or of wood-pulp, covered with glazed paper. They are generally about $\frac{1}{20}$ inch thick. The shapes in use are :—

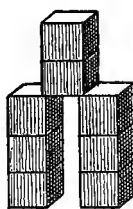
1. Squares of 1 inch.
2. Half-squares, that is, right-angled isosceles triangles, formed by cutting the squares diagonally.



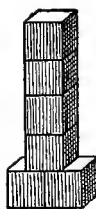
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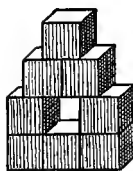
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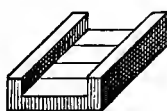
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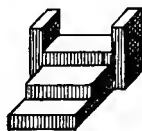
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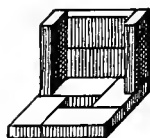
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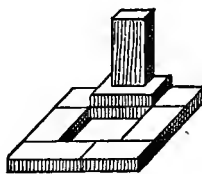
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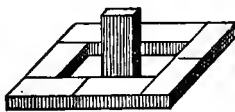
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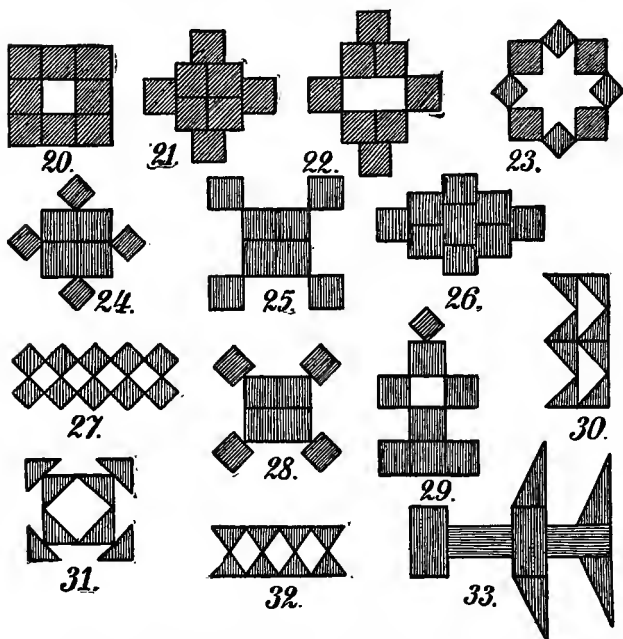


18.



19.

3. Oblongs or double squares.
4. Equilateral triangles, the length of a side being 1 inch.
5. Scalene triangles, formed by cutting the equilateral triangles in the direction of the perpendicular from the vertex on to the base.



6. Obtuse-angled isosceles triangles, formed by bisecting the angles of the equilateral triangles and cutting to the point where the bisecting lines meet.

Not only can we, by means of these tablets, convey to the child an immediate¹ perception of the elementary geometrical forms, but they afford an excellent means of reproducing and analysing various shapes in the world of life and beauty.

¹ Used technically for *Anschaung*. See Hailmann as quoted. Russell (*Life of Pestalozzi*) employs "sense-impression."

They will also be found of great utility for counting, drawing, and language exercises. The Figs. above (20-33) exhibit different ways in which the number 8 can be represented by the aid of the tablets, without by any means exhausting the possible combinations for the purpose. The child will devise for itself new forms—an occupation at once delightful and conducive to its mental development.

To tablets bounded by straight lines are afterwards to be added circular tablets (or discs). The former may be conceived as limiting the cube and its parts, the latter as limiting the cylinder. The disc forms the transition between cylinder and ring.

3. STICK-LAYING.

The sticks required are from 1 to 5 inches long, and of the same size in other respects as common matches. They should be coloured rather than white, as one of the objects with which they are used is to awaken and develop the colour-sense. The exercises present great variety, and are in a high degree interesting and instructive.

Although the sticks are exceedingly cheap, it is to be recommended for many institutions that boys of eight or nine years should make them for themselves. The doing so is an exercise in the use of the knife. Blocks of wood, 2 inches thick, are chosen, and split downwards with the grain into rectangular splints, which are painted by the boys themselves with suitable colours. The best wood for the purpose is that of the spruce fir (*pinus abies*), which can easily be split. Serviceable half-round sticks can be made from cane or withies.

Stick-laying should be closely combined with drawing. Single sticks or patterns are arranged on the checkered slate. The child then removes them one by one, and represents each in turn by a line. Lastly, it reproduces with the sticks on the table what it has drawn on the slate.



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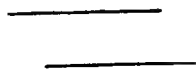
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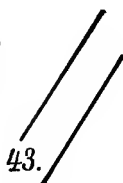
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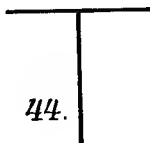
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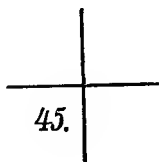
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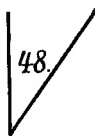
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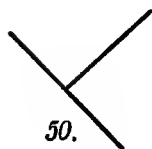
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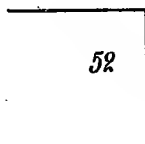
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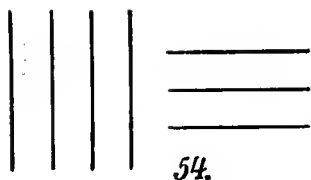
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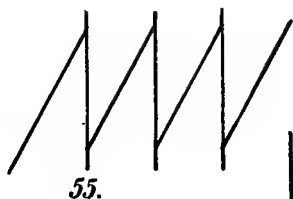
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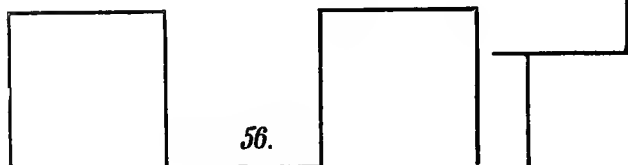
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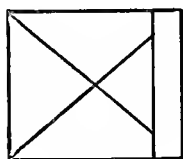
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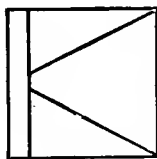
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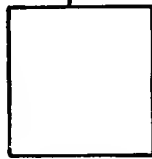
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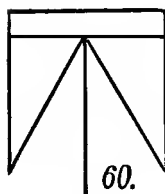
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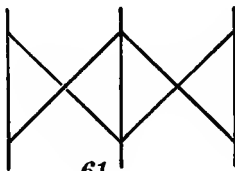
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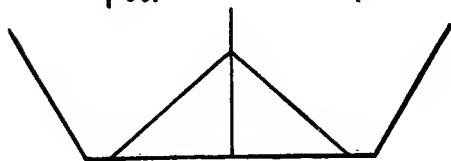
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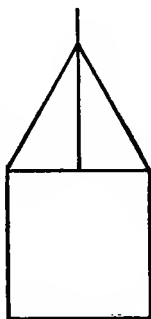
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



63.

The value of stick-laying in communicating an idea of number and a knowledge of simple processes of reckoning cannot be overestimated. One method of procedure is that of Goldammer: ¹—.

Each child receives a packet of ten sticks, and the teacher begins: "Take a stick and lay it perpendicularly on the table (*i.e.* so as to be perpendicular to the edge of the table). Take another and lay it by the first one. How many have you on the table now? One and one are two. Lay another down. How many are there now? One and one and one, or two and one, are three. Now another." And so forth, until all ten are upon the table.

"Now take one away. How many are left? One from ten leaves nine. Take another away. How many remain? One from nine leaves eight. Take away another. There are left?" Seven. The process is continued until all the sticks are again in the child's hand.

"Take two sticks from your hand and lay them on the table; two more, and lay them a little way off ( ). How many have you on the table now? Two and two are four. Now two more. Two and two and two, or four and two, are six. Two more. Six and two are eight. Two more. Eight and two are ten."

The child has thus learned to add two sticks at a time and to find the resulting number. Reverse the process and it will have learned to take away two at a time.

We continue in the same way with sets of three, four, and five. Then we interchange addition and subtraction, but confine ourselves to multiples of the same number (not unity). Thus we cause the children to lay three times two sticks on the table, then to take away twice two, and to add four times two. Lastly, we dismiss the restriction, and add, for instance, two and three (equals five), five and two (equals seven), seven and three (equals ten). We can now, more often than in the previous exercises, present the

¹ *Kindergarten Guide* by Goldammer, 10s. 6d.

numbers from 6 to 9 to the child as distinct wholes. We pursue the same course with regard to subtraction, and finally interchange addition and subtraction of unlike numbers. For example, the children lay down six sticks, take two away, add four, take one away, add three ; and are required after each operation to declare the result—four, eight, seven, ten.

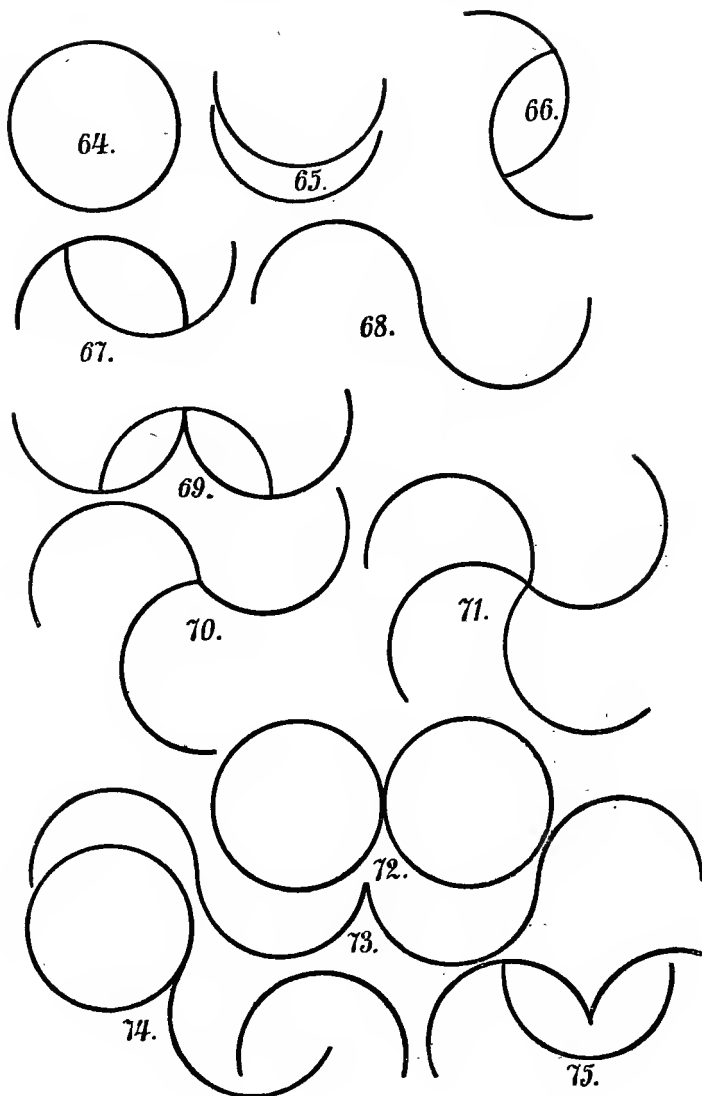
In Figs. 34 – 63 various methods of illustrating the numbers 1, 2, and 7 are given.

4. RING-LAYING.

Rings, half-rings, and quarter-rings of iron-wire coated with zinc yield a multiplicity of new and graceful forms, and enable us to pass from the straight lines of stick-laying to curves. The rings may be made by binding the wire tightly round a gas-pipe or other cylindrical body (1 in. or 2 in. in diameter), and then cutting with a triangular file or with a chisel into halves or quarters, as required. The rings can also be bought at the cost of about 3s. 6d. for a box containing two dozen circles, two dozen semicircles, and four dozen quarter-circles.

We restrict ourselves as before to numbers not greater than ten. The following rules must be observed :—

1. When once a form has been made, each new form should spring from it. Do not destroy ; change little by little.
2. Do not lay ring *on* ring, but place ring *beside* ring, with ends in contact. If you have different sizes, you may also put one ring within another.
3. Start from the number one ; take one more, and make all possible forms with the two ; then one more, and make what you can with the three. Exhaust the possible forms with the number you are using before you increase it.
4. Try to draw the forms you have made. You may do this on a plain or checkered slate.



Figs. 64–75 contain a number of forms within the limit of from one to ten. They will serve to show how the process is developed for higher numbers.

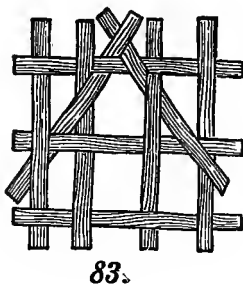
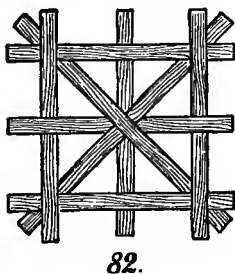
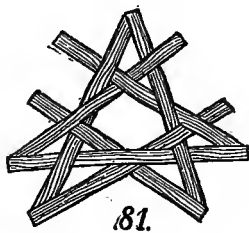
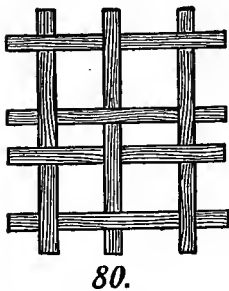
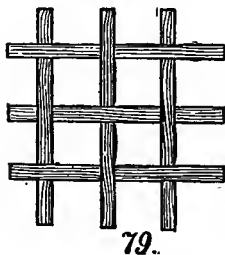
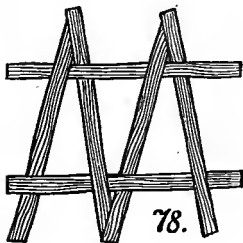
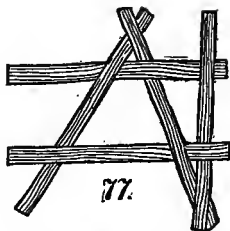
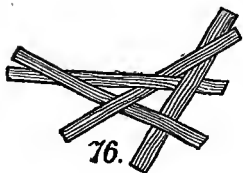
5. INTERLACING SLATS OR LATHS.

This occupation, in which children, especially boys, take great delight, forms a transition to the construction of surfaces.

We have often cut the slats from a thin maple board, $\frac{1}{2}$ in. thick and 4 in. long, by drawing a sharp-pointed knife along the edge of a ruler. This can be done very rapidly. Bigger boys can make their own slats from what are called roof-shingles, and colour them by laying them in wood-stain. Walnut-stain, which is easily prepared or procured, gives an agreeable hue. In England the slats used are 5 or 10 in. long and $\frac{3}{8}$ in. wide. Bought ready-made, they cost 3s. a gross for the larger size, or if of cardboard, 2s. 6d.

Even with from four to ten sticks a long series of forms and relations of forms can be represented. The thinking faculties and the natural impulse towards making and fashioning are stimulated. Each form produced is a victory which encourages the child to renewed effort. With three slats he can make the same patterns as in stick-laying. Add a fourth, and explain the method of interlacing. He now finds that he has made a step forward: he can lift his work from the table without destroying what he has made. Moreover, he can change the shape without breaking up the structure.

Appended are a few examples (Figs. 76–83) of the forms which can be produced with not more than ten sticks.



6. WEAVING OR BRAIDING.

For work of this kind common white writing-paper and coloured glazed paper may be employed. The use of thicker paper, thin cardboard or pulpboard, gives a firmer and more durable product. The exercises are done by drawing strips of paper shuttle-wise through cuts in a prepared sheet, called the mat. Mats and strips of all sizes and qualities may be obtained from Kindergarten publishers, but may also be made by the teacher thus: take a piece of paper $5\frac{3}{4} \times 9\frac{1}{2}$ in. and fold it lengthways; on the outside draw a square of $3\frac{3}{4}$ in. so as to leave a margin of 1 in. on every side except where the fold is; on the two sides of the square which are at right angles to the fold mark off spaces of $\frac{3}{8}$ in.; join the opposite points of division by five lines, and cut along these through the double sheet; unfold, and make along the crease a cut of the same length as the others; press the paper quite flat. To obtain the strips, take a larger sheet of a different colour and cut along lines $\frac{3}{8}$ in. apart. The strips are drawn through the mat by means of needles, the best being of steel and of the same width as the strips. The latter can be bought in smaller sizes, $\frac{3}{16}$ in. or $\frac{1}{8}$ in.; but for children at the stage which we are now considering the size $\frac{3}{8}$ in. is most to be recommended. Moreover, the learners should be confined to very simple patterns and to the use of ten strips at most. The width of the mat-strips is the same as that of the loose ones.

Mat and strips are given the child ready-made. The exercises will be found very useful as a basis of instruction in reckoning and drawing. It need hardly be said that they assist materially in training the colour-sense. Care should accordingly be taken to contrast suitable colours. In the first exercises a blue mat and white strips will give a pleasing result. Then we may try a white mat and green, red, and black strips; then a grey or brown mat and blue, white, and orange strips.

As the needle draws the loose strips through the strips of the mat, some of the latter are above, others below, the crossing strip. To describe a pattern, we specify how many of the *mat-strips* are above, and how many hidden below. Here follow descriptions of the accompanying patterns (Figs. 84-91):—



84.



88.



85.



89.



86.



90.



87.



91.

(*a* = above ; *b* = below.)

- | | | |
|-----|--|--------------------------------------|
| 84. | 1 <i>a</i> , 1 <i>b</i> , 1 <i>a</i> , 1 <i>b</i> , and so on. | First line, continued to end of mat. |
| | 1 <i>b</i> , 1 <i>a</i> , 1 <i>b</i> , 1 <i>a</i> , .. | Second line, |
| | 1 <i>a</i> , 1 <i>b</i> , 1 <i>a</i> , 1 <i>b</i> , .. | Third line, |
| 85. | 2 <i>a</i> , 1 <i>b</i> , 2 <i>a</i> , 1 <i>b</i> , 2 <i>a</i> , 1 <i>b</i> , 1 <i>a</i> . | |
| | 1 <i>b</i> , 2 <i>a</i> , 1 <i>b</i> , 2 <i>a</i> , 1 <i>b</i> , 2 <i>a</i> , 1 <i>b</i> . | |
| | 2 <i>a</i> , 1 <i>b</i> , 2 <i>a</i> , 1 <i>b</i> , 2 <i>a</i> , 1 <i>b</i> , 1 <i>a</i> . | |

86. 1a, 2b, 1a, 2b, 1a, 2b, 1a.
 2b, 1a, 2b, 1a, 2b, 1a, 1b.
 1b, 1a, 2b, 1a, 2b, 1a, 2b.
87. 1a, 1b, 2a, 1b, 1a, 1b, 2a, 1b.
 2a, 1b, 2a, 1b, 2a, 1b, 1a.
 1b, 2a, 1b, 2a, 1b, 2a, 1b.
88. 2a, 2b, 2a, 2b, 2a.
 2b, 2a, 2b, 2a, 2b.
 2a, 2b, 2a, 2b, 2a.
89. 2a, 1b, 1a, 1b, 2a, 1b, 1a, 1b.
 1a, 1b, 2a, 1b, 1a, 1b, 2a, 1b.
 1b, 2a, 1b, 1a, 1b, 2a, 1b, 1a.
90. 2b, 2a, 1b, 1a, 2b, 2a.
 2a, 2b, 1a, 1b, 2a, 2b.
 2b, 2a, 1b, 1a, 2b, 2a.
91. 1b, 3a, 3b, 3a.
 1a, 3b, 3a, 3b.
 1b, 3a, 3b, 3a.

It will be observed that in the patterns exhibited above, the mats are ten strips wide. Nor should this limit be exceeded if the work is to be used in connection with counting lessons. Otherwise, larger mats, such as that the construction of which was given on p. 25, may be profitably employed. The child realises the pattern more vividly when it is on a larger scale.

7. FOLDING.

The folding-sheet is a means of occupation which introduces the child to a number of new and various forms. It has the advantage of being the cheapest of all the occupations. Any kind of paper may be used—note-paper, surface-paper, both sides coloured, paper of various tints, etc.

In the first exercises the folding-sheet is square. For them we recommend paper white on one side, coloured on the other. Papers white on the inside and silvered or gilt on the reverse, are by no means unsuitable. Paper of this

kind causes the forms produced to stand out clearly, and enables the teacher to simplify the instructions given.

The sheet is shaped before it is placed in the child's hands. Attention should be called to the lines or creases as well as to the ultimate outline.

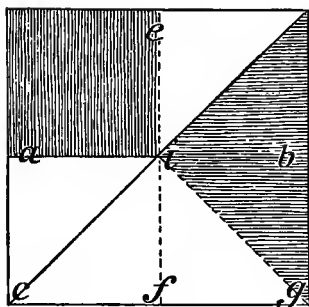
Fig. 92 yields four forms. (1) Folded along $a b$, it gives an oblong. (2) Folded along $c i$, or diagonally, it shows the form of a right-angled isosceles triangle. (3) Folded along $a b$ and $e f$, the form resulting is that of a square one-fourth the size of the original square, that is to say, not properly a new form, but a known form of smaller dimensions. (4) So, if we fold along $c i$ and $i g$, we have another right-angled isosceles triangle, smaller than (2).

The teacher will, of course, use discretion as to the introduction of mathematical terms. The essential thing is that the learner should observe the *qualities* of the shape produced by his work.

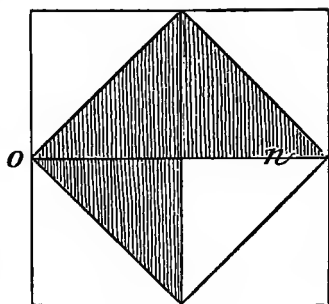
From Fig. 93 we also derive four forms. (1) Folding along $o n$, then unfolding, and turning down the two top corners to meet in the middle point of $o n$, we get what is called the barn gable. (2) Folding the barn gable along the perpendicular from the point of the roof gives us the gable end of a stable. (3) Beginning with the barn gable and turning another corner down to the middle point shows us the gable end of a house. (4) Fold the fourth corner, as well as the other three, to the middle point, and you have the letter.

[How do the three gables differ? How many points has each figure? How many corners (angles)? Are the corners all alike? Draw them on the slate and see.]

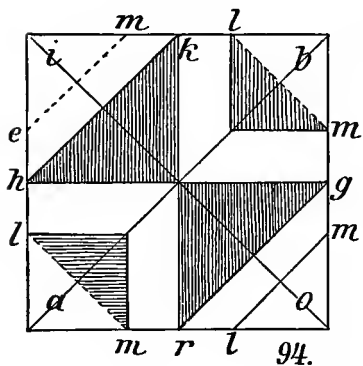
Fig. 94 again shows us four forms. (1) Fold along $i o$ and $a b$ to obtain the middle point, the intersection of the diagonals; unfold, and turn o the right-hand bottom corner on to this point; we then see the five points of an ivy leaf ($r a i b g$). (2) Turn i as well as o on to the middle point, and we have a six-sided figure (hexagon). (3) Fold the hexagon so that its two longer sides come together; this gives



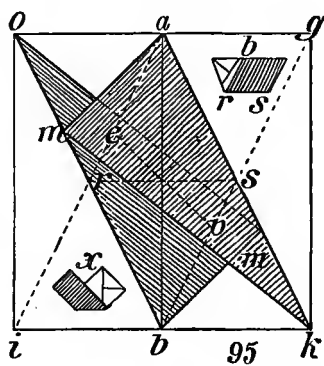
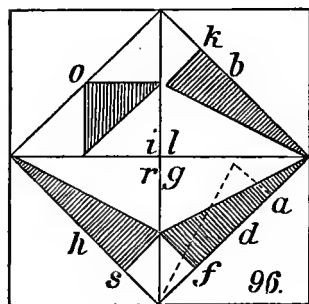
92.



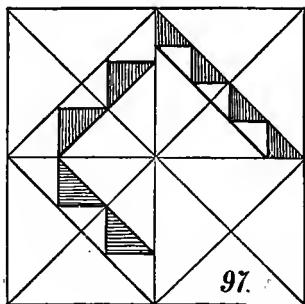
93.



94.

95 *k*

96.



us the outline of a boat. (4) Open again, and fold along $l m, l m, e m, l m$, that is, turn all four corners down, but not as far as the middle point; we have made an eight-sided figure (octagon).

[As to (2), show the child a regular hexagon and explain the difference.]

Fig. 95 indicates the method of producing six forms. (1) Fold along $a b$, and open; then fold along $o b$; the form is like half the middle stone of an arch, but wider. (2) Fold along $o b$ and $a k$; we have made a rhomboid. (3) Fold along $a i, g b$, and $a b$; we obtain a bridge. (4) Fold along $o b, a k$, then along $r s$, so that b falls on a ; the form is that of the front or back of a cart with sloping sides. (5) Fold along $a i, b g$, then along $e v$, so that i falls on g ; the result is a pentagon. (6) Fold along $o b$ and $a k$, then in such a way as to produce the small figure x —a boat with two sails—drawn inside the square. After each exercise the sheet is supposed to be opened.

Fig. 96 gives three forms. Make the letter as described in connection with Fig. 93.

Then—

First form— i on o , l on b , g on d , r on h .

Second form— r on s , g on f , and so on.

Third form— r on s , g on a , l on k , and so on.

Fig. 97 exhibits two forms. They are likewise derived from the letter by folding the flaps back. Crease twice to obtain the first form; three times to obtain the second. In the former case the points of the flaps are brought on to the sides of the inner square; in the latter, they rest on the sides of the outer.

In these forms the teacher will have material enough for the present stage. Those of a more complex character lead to weariness and distaste for the work. The folding-sheet affords excellent *Anschaunungsmittel* for drawing lessons and for conveying notions of space. The exercises should be repeated at a later stage, and additions made to the number of them.

8. MODELLING OR MOULDING.

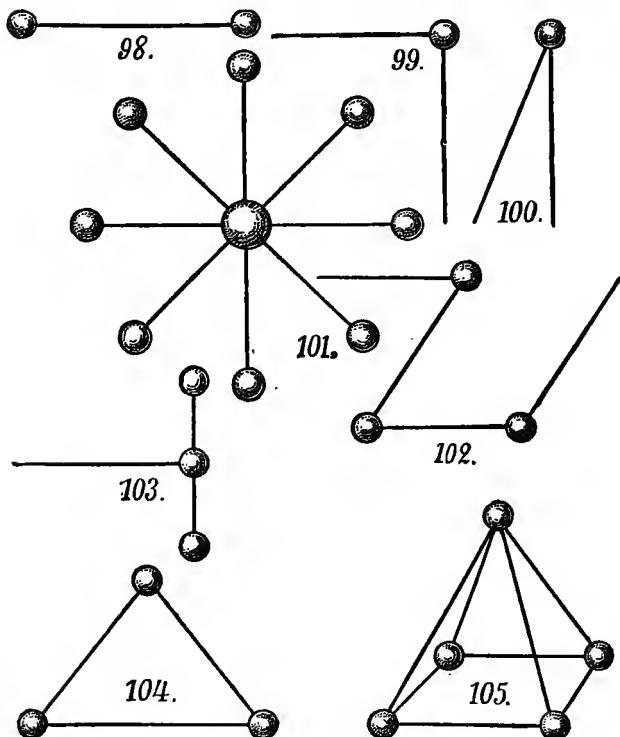
Moulding with clay or sand causes a high degree of pleasure to boys and girls alike. Children of from two to ten years of age will occupy themselves for hours making bricks with clay, or forts and mills with the sand on the beach. Their natural impulse is to busy themselves, and they adopt the first means that offers. But many days in summer, and in winter still more, do not admit of open-air employments. We can then utilise what we may call the plastic instinct of the child, and set boy or girl to moulding indoors. For younger children, plastilina or Italian modelling clay, which preserves its pristine moisture, is the most suitable material; older ones may use modelling clay or wax.

When the name of the subject is mentioned, a difficulty arises. The words *moulding* and *modelling* are often used as interchangeable. It would perhaps be wise to confine *moulding* to those exercises in which a mould or form is used, as in Sonntag's¹ system of brick-making, modelling to those in which the hand is free. At present we use the term *moulding* for our simple exercises for boys of six or seven, and recommend the following:—

- (a) The sphere (ball) is produced by rolling the material in the palms of the hands. From the sphere the workman should form a cherry, an apple, a pear, a hemisphere (half-ball), an egg, a loaf, a button, a nest (a hemisphere with the inside hollowed out), an orange [and the form of the earth is . . . ?]
- (b) The cylinder (garden roller, or roll of bread) is made by rolling the sphere on a flat surface, a sheet of tinned iron, a slate, or a board, while the hand, kept parallel to the plane of the surface, exerts a downward pressure. Then from the cylinder we can derive stick, pointed pencil, nail with head, mushroom (cylinder crowned with a hemisphere), half-ring, and whole ring.

¹ See Götze, *Manual of Hand and Eye Training*, pp. 113–15.

- (c) The cone. If, after forming the cylinder, we press more heavily on one of its ends than on the other, a cone is produced. The soft plastilina or clay may then be developed into a club, a snake, the figure 8, or a ring.



- (d) The disc is formed by flattening the sphere considerably and squaring the edges. From the disc we may fashion wheel, plate, or pendulum (disc with rod).

This last step, the joining of the disc with the rod, leads naturally to cork and pea work. But at the present stage we confine ourselves to suggesting such simple combinations of the sticks used in stick-laying with little balls of plastilina as are shown on the opposite page (Figs. 98-105).

Perhaps our readers will forgive us for repeating that the child must be led to *examine* every form produced.

9. BRIEF REMARKS UPON THE OCCUPATIONS AND THEIR APPLICATION IN THE SCHOOL.

First school-year (six to seven).

Occupations with *Spielmittel*¹ may have a double purpose: first, to *employ* the child, so that in the exercise of its faculties it may strengthen its bodily and mental powers; secondly, to *instruct* it, not in an abstract but in a practical way, by means adapted to its capacity for doing and thinking. To effect the first of these objects is the task of the home; the second belongs to the province of the school.

The employment of children in their own homes should be conducted with some sort of system; but the system need not be strict, and deviations are not only permissible, but even desirable. On the other hand, the school must follow a definite plan, every detail of which has been carefully elaborated with a view to securing the best possible educational results. Premising that the occupations, as given in the preceding and following sections, are not intended to be pursued in regular sequence, but to be carried on side by side, we now offer illustrations of the method in which we conceive instruction should be imparted during the first school-year, and of combined lessons in language, writing, reading, reckoning, and drawing.

¹ Toys with an educational tendency, Kindergarten appliances.

The number one.

One stick. — | / \ (Every child receives one of the sticks described in section 3.)

Ideas: beginning, end, top, bottom, right, left, before, behind, vertical, horizontal, oblique, round, cornered, side, edge.

What things have the same form? Needle, pencil, flower-stick, walking-stick.

Reckoning: The number one. $1 - 1$; 1×1 .

Language: The stick stands.

The stick lies.

The stick rolls.

The stick is smooth.

The stick is round.

The stick is white, etc.

Exercises preliminary to reading: The splitting up of monosyllables—

at = a—t.

an = a—n.

of = o—f.

re = r—e.

to = t—o

As in the examples given, the vowel sound should sometimes precede, sometimes follow the consonant.

Writing and drawing: || = // \ \ etc.

A tablet, the table. □ □ ▴ ▴.

(Every child receives one tablet. See section 2.)

Language: The tablet stands, lies, etc.

The tablet is four-cornered.

The tablet is red.

The tablet is green.

The tablet is black, etc.

The four-cornered tablet, etc,

The red tablet, etc.

The red tablet stands, lies, etc.

The table—the tablet.

The lamb—the lambkin.

The stream—the streamlet.

Reckoning: $1 - 1$; 1×1 ; $1 \div 1$.

Drawing: $/// \quad ||| \quad = \quad =$

Exercises preliminary to reading: an—na, in, not, let, now, thus.

The number two.

Two sticks. Ideas: over, under, near, upper, lower, pointed.

Language: The sticks stand.

The sticks lie.

The sticks roll, etc.

The stick stands.

The sticks stand.

The contrast, or opposition, between *one* and *two* is to be emphasised.

One stick stands, two sticks stand, etc.

The white stick stands, the white sticks stand.

The stick is red, the sticks are red, etc.

Reckoning: $1 + 1$; $2 - 1$; $2 - 2$; 2×1 ; 1×2 ; $1 \div 2$; $2 \div 2$.

Drawing and writing: $\backslash \quad \backslash \quad \backslash \quad \angle \quad \angle \quad \angle \quad \backslash \quad \backslash \quad =$
 $+ \times$ etc.

Exercises preliminary to reading: as before.

Two tablets. The tablet, the tablets.

The table, the tables.

Ideas: round, long, broad, thin, angular.

The other exercises may be developed as before.

The ring and the half-ring may now be added. (One into two goes twice.)

Thus with every number the instruments for the cultivation of the perceptive faculties and for instruction in language, drawing, and writing are multiplied. With the number 4 the sphere, a ball of plastilina, is brought into use as well as the folding-sheet; with 5 the cylinder and the disc appear and the interlacing of slats is begun; 6 brings the cube, 8 the first two building-boxes, and so on. We are thus provided with material for a whole year. The hints we have given will suffice for the practical teacher, who will have no difficulty in applying them, especially if he (or she) has had some experience of Kindergarten work.

II.

Age—seven to eight. Second school-year.

FORM-LAYING AND THE FASHIONING OF FORMS.

A. Without tools. B. With the aid of the scissors.

(The number of form-parts goes beyond 10. The limit in reckoning is 100.)

I. BUILDING WITH FRÖBEL'S BUILDING-BOXES (GIFTS FIVE AND SIX), AND WITH OTHER BOXES OF BRICKS.

FRÖBEL's fifth Gift consists, as we have seen, of a 3-inch cube divided into twenty-seven 1-inch cubes. But a further modification is introduced: three of the small cubes are divided diagonally into halves, and three others cut, also diagonally, into quarters, the box containing in all 39 pieces. We are thus enabled to make a considerable addition to the forms produced, and the number is further increased if we combine the sixth Gift with the fifth. Highly to be commended as a means of occupation are the *Ankersteinbaukästen*, made by F. Ad. Richter & Co., of Rudolstadt. The size (100 bricks) required at our present stage can be obtained in England for about 5s. Some of their boxes contain as many as 1400 pieces, and cost £3. The coloured stones and the weight of them prove very attractive to boys.

There are three methods of procedure in this occupation.

(1) The boys may imitate the designs supplied with most

boxes of bricks. Useful and necessary as this work is, it should not be too long continued. (2) They may build known objects suggested by the teacher. The following list may be useful: flight of steps, chair, horse-trough, house, various forms of the cross, church, factory with chimney, temple, castle, park-gate, set of pigeon-holes for papers. (3) They may work quite independently, choosing or inventing their own forms.

As before, the rule is: never destroy, but change what you have made. All the pieces should be used, if not for the main structure, for something naturally belonging to it. The children should state what these accessories are and for what purpose they are used.

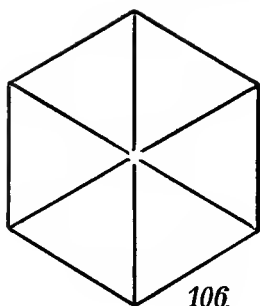
In school-teaching building-boxes will be found especially useful in reckoning, and local geography will occasionally justify their introduction. A model of the schoolhouse may be made, or a ground-plan of the town or village.

2. STICK AND TABLET-LAYING.

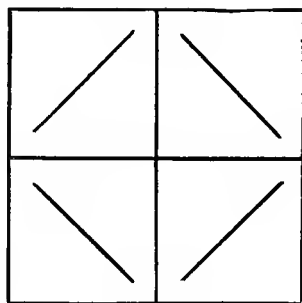
These simple occupations yield, as the number of the implements is increased, an excellent means of utilising a child's impulse to self-activity.

Sticks of 4 and 8 inches, round, half-round, and quadrangular, now make their appearance. This in itself is a cause of enhanced interest. New series of mathematical forms, and forms taken from real life or the world of art, can be developed. And so it is with the tablets. The learner will have already made acquaintance with equal magnitudes of the same shape; he may now be introduced to those which are equal, but unlike in shape.

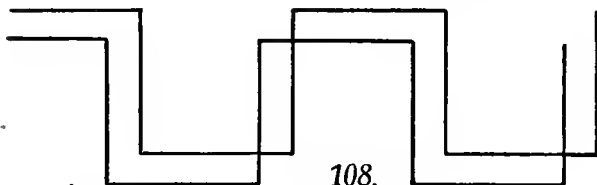
Both sticks and tablets furnish, in the school, valuable material for instruction in reckoning and drawing, and in the home a means of employment and recreation. Figs. 106-111 and *a* to *g* exhibit by means of a few examples



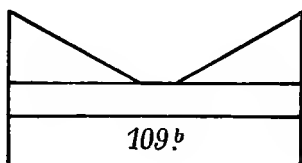
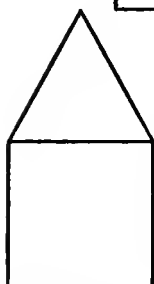
106.



107.



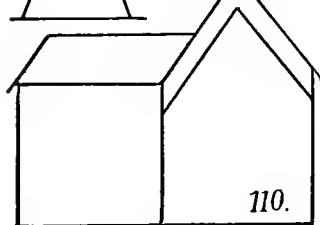
108.



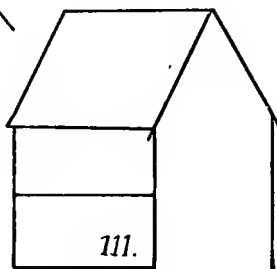
109^b



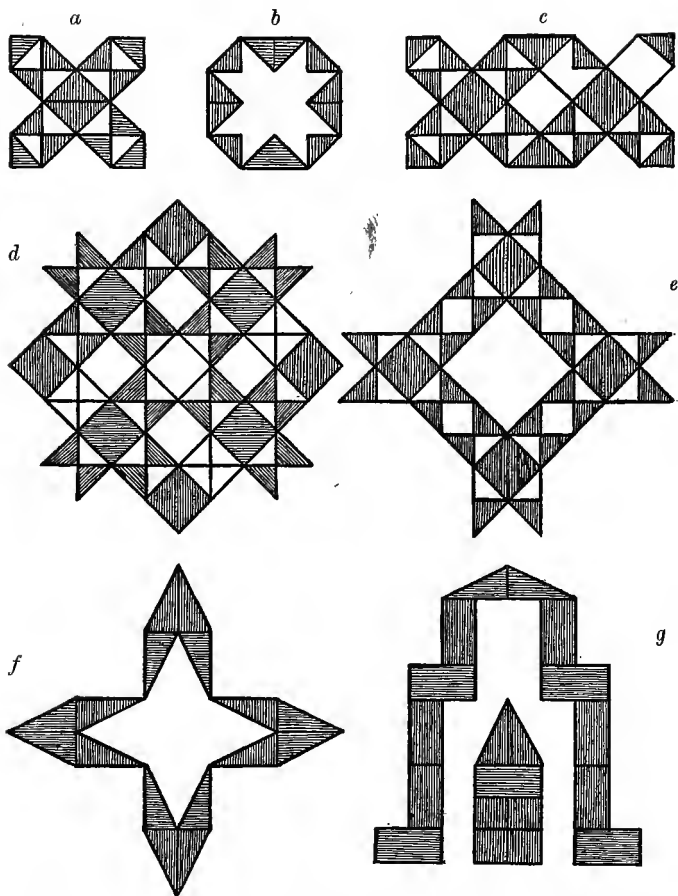
109^c



110.



111.



the rich variety of form that can be obtained ; indeed, the inventive faculties of the child have an almost boundless field for exercise.

3. INTERLACING SLATS (more than ten).

Interlacing with more than ten slats presents considerable difficulties. Hence the work affords an opportunity of testing and strengthening the will-power and perseverance of the boy. Often he believes that his figure is nearly complete, when a slat slips from its place and the whole structure falls to pieces. But if he learns *why* this happened, he will be encouraged to begin again, and success will eventually crown his efforts.

The elementary forms made with not more than ten slats (see p. 24) should be repeated, then new ones produced from these by means of additional slats. Stars lend themselves readily to this treatment; and if longer slats be introduced, a number of pretty and interesting patterns for barred gates and fences may be devised. That the teacher may have the most important designs always in readiness, he should after making them fasten the joints with small tacks or pins.

In this occupation, as in others, great importance is to be attached to examining: the child must consider and describe the constituent parts and the qualities of the whole.

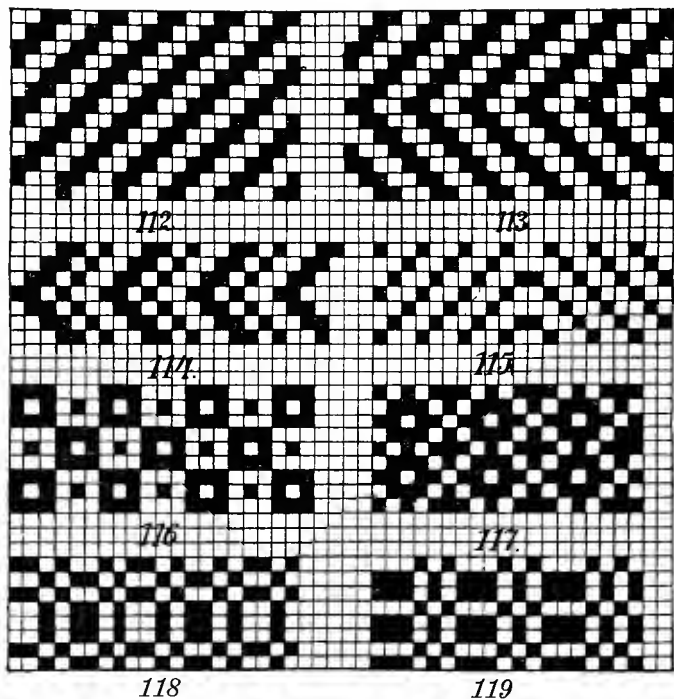
4. WEAVING OR BRAIDING OF COMBINED PATTERNS, AND INTERTWINING.

In this stage as in the preceding one, mats and loose strips are given the boys ready for use. Perhaps the more experienced of them may attempt with the scissors the cutting of their own strips; but they must first mark carefully the points of division on the edges of the sheet and join them by ruled lines. For patterns on a large scale the $\frac{3}{16}$ in. strips may now be used.

The patterns are rendered particularly attractive by the employment of different but harmonious colours. For instance: a white ground (mat) with blue, green, and orange

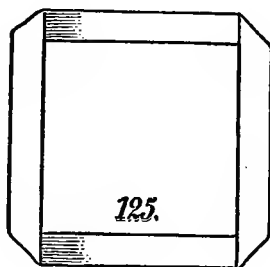
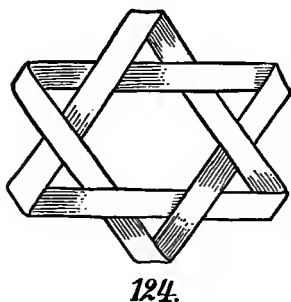
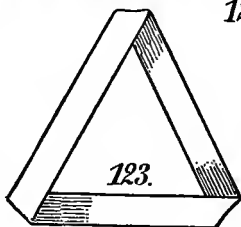
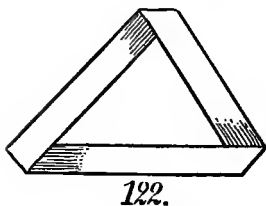
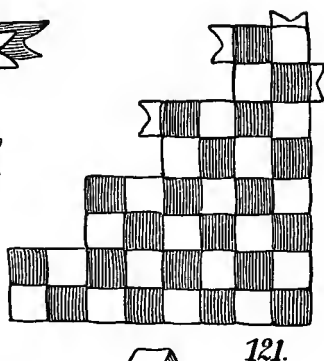
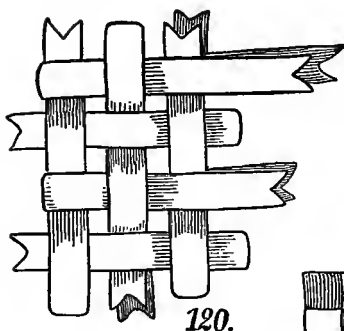
strips ; or a green ground with white, black, red, and brown strips, will be found effective.

The learner will be at once struck by the resemblance of the patterns to those of the woven fabrics with which he is acquainted.



The above figs. (112-119) contain a number of designs suitable for the present stage. The packets of material, supplied by dealers, often contain coloured diagrams.

After weaving with the net we may proceed to what is called free weaving. The method is illustrated by Fig. 120.



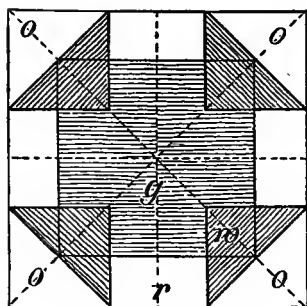
Take two or three strips of white paper, fold them double, and place them so that the folded end of the one to the left is at the bottom, that of the next at the top, and so on. Then cut two or three shorter slips of a different colour

(say, blue); draw one of these *round* the first white strip on the left, *through* the second, and so on. With the second blue strip proceed as with the first, but begin at the right-hand side, and in such a way that if the right-hand white strip was covered before it is now exposed; if exposed, now covered. The number of strips and their colours are at the discretion of the worker. When the strips have all been woven in, they are drawn tight and the ends secured with glue. Projecting pieces may be removed with the scissors, or cut into pennon shape, as in Fig. 120. Fig. 121 represents another development of free weaving. Book-markers of various kinds and ornamental crosses are the commonest objects produced by this occupation. The designs may be altered by varying the width of the strips used.

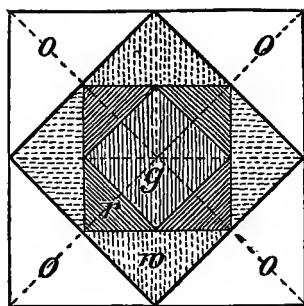
In Figs. 122–125 simple forms of intertwining are shown. The corners, except the last, which is fastened with paste or glue, are simply pressed with the finger. Strips of glazed or packing paper, $\frac{3}{8}$ in. or $\frac{3}{16}$ in. wide, are commonly used; but the work, as well as weaving, can be executed with leather, oil-cloth, ribbon, or wood. Thus with strips of oil-cloth, woven into a round or square form, we can make pretty little table-mats; with wood shavings, moistened before use, we may weave a basket with handle, such as is seen in Fig. 251 *b*.

5. FOLDING AND MOUNTING.

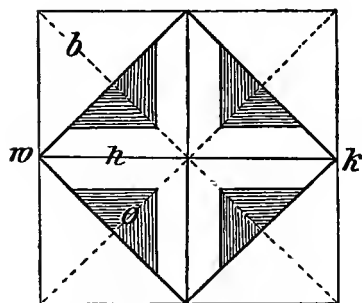
The little learner is now, we trust, so far skilled that we may trust him with a pair of scissors as a tool, and let him handle a brush with glue or gum. Moreover, he must learn how to manage lead-pencil and foot-rule (marked to eighths of an inch), in order that he may measure and draw lines for himself. His first attempts must be on cheap, unprinted paper. Afterwards, when he has gained some experience in measuring, ruling, and cutting with the scissors, coloured paper may be given him. Glazed paper,



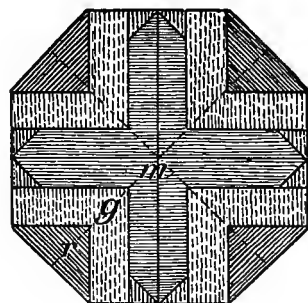
126.



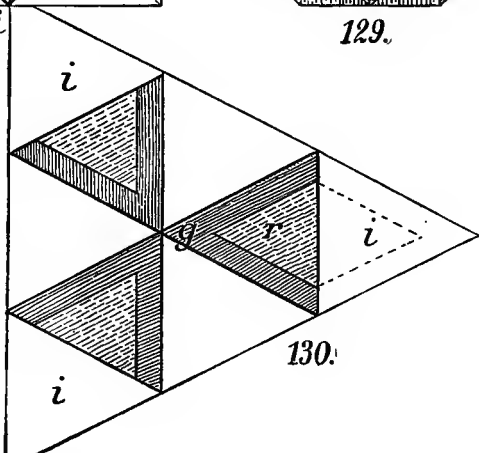
127.



128. *i*



129.



130.

both sides coloured paper, or thick printing paper, will serve for the purpose.

The forms already practised (Figs. 92–97) should be repeated, and new ones connected therewith. In Figs. 126–130 a few patterns for mounting are represented. As the drawing lessons proceed, the number may be multiplied, and all will afford excellent means for intuitive instruction.

Fig. 126 is a combination of three squares; two have sides $4\frac{1}{2}$ inches long; the third, a 3-inch side. Surface paper is used, white on one side, coloured on the other. The undermost square *oooo* is grey; on it lies the equal square *r*, which is red; the smaller square *g* in the middle is green. The points *w* of *r* being folded over show the white under-side of the paper. The parts of the design are fastened together with glue, which is laid on as thin as possible with a small brush.

Fig. 127 is also produced by means of three squares. One *o* is light-green; another *w*, of the same size as *o* but folded into letter form (see p. 28), is white underneath, red above; thus when the points of the letter flaps are turned back, the red triangles *r* are shown; *g* is a smaller square of dark-green.

Fig. 128. Square *b* brown; smaller square *o* orange; square *h* blue. The pattern is produced by folding along *i k*, *i w*, and so on.

Fig. 129. Three equal squares, *r* red, *g* green, *m* pink. The pattern is easily formed by folding the corners.

Fig. 130 has its origin in two equilateral triangles, the smaller red and the larger green. The larger one is uppermost, and its corners are turned down to the middle point of the triangle so that its outline becomes hexagonal; the corners of the smaller triangle below are thus exposed, and these are in turn folded over, as *r*.

Many other combinations may be developed, with square, triangle, hexagon, or octagon as a basis.

6. MOULDING OR MODELLING IN PLASTILINA.

It is recommended that boys should start as before with the sphere, and should add new forms to those with which they are already familiar. For example :—

The sphere (ball). From this they derive the nut, plum, basin, and bell.

The cylinder. Hence the stick, bent subsequently into letters, figures, etc.

We then add—

The cube ; dice, sphere on cube, pillar, sphere on pillar.

Square prism ; large cube as pedestal, upon that pillar, the whole crowned with a sphere.

Square prism halved (slab) ; arches of various forms.

Pyramid with square base.

Lastly, the various elementary forms are combined into objects from real life : the house, tower, steeple, bridge, etc.

7. CORK AND PEA WORK.

The outlining of solids by means of sticks.

For work of this kind a considerable degree of manual dexterity is required, and want of skill will cause many failures. Nevertheless, the attempt should now be made to outline simple solids.

The material consists of small round sticks, from 2 to 5 inches long, or of wire about as thick as a hairpin ; indeed, broken hairpins are themselves not unsuitable. To join the sticks at the points of contact we may use little balls of clay, wax, or plastilina. Peas which have been soaked in water for from eight to twelve hours, then dried for an hour, are also employed. If the material chosen is wire, small pieces of cork are the best fasteners. A pricker is used to bore holes in the corks. Small metal tubes have recently been introduced to supersede corks and peas ; they give increased strength and stability to the forms constructed.

In the earlier stage (Figs. 98-104) we dealt with plane-figures; we pass now to solids, or figures of three dimensions. On the triangle we build up the tetrahedron; on the square, the four-sided pyramid and the cube; on the oblong, the quadrangular prism, etc. Figs. 135 and 136 are combined forms, and indicate to the learner the way in which he may proceed to build up structures of his own designing.

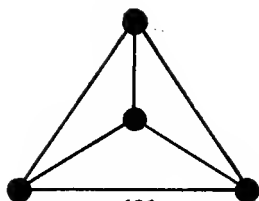
We observe, in conclusion, that sticks or wires can be pointed by rubbing them on sandstone or sand-paper.

8. CUTTING OUT AND MOUNTING.

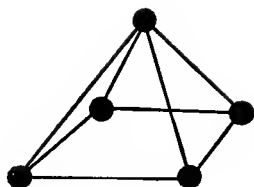
Cutting out is excellent training in the use of the scissors. A boy delights in cutting soldiers, beasts, etc., from picture-sheets; if, before or after the cutting, these are mounted on stronger paper or cardboard, he may provide himself with a whole army at but little cost. If he fastens the soldiers he has cut out on to little slips of wood, $\frac{3}{16}$ or $\frac{3}{8}$ of an inch thick, he can make them stand; or he may obtain the same result by cutting little slits in a piece of thin board or wood-pulp and inserting his mounted figures therein. By grouping the smaller ones in front, the larger ones according to size behind them, he may often produce a perspective of very happy effect.

Picture-sheets can readily be obtained; but a boy can without them cut with the scissors and a piece of paper folded double a long series of pretty patterns, and then mount them. At present we confine ourselves to straight cuts.

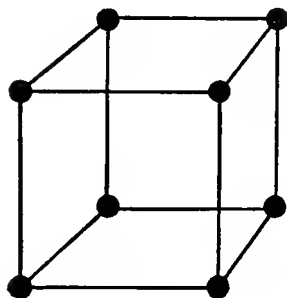
To produce the forms given in Figs. 137-144, we avail ourselves of the ordinary folding-sheet, a square of glazed paper, each side measuring 4 inches. The sheet is folded diagonally, and the longer side of the resulting triangle assumed as the base. Fold again along the perpendicular from vertex to base; a new right-angled triangle is produced;



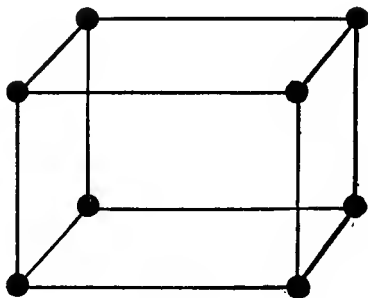
131.



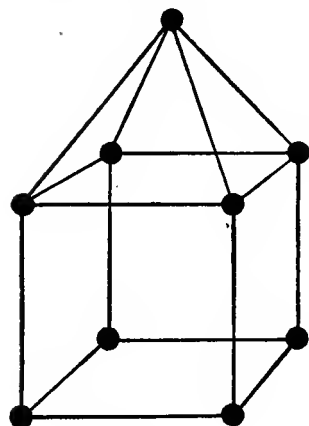
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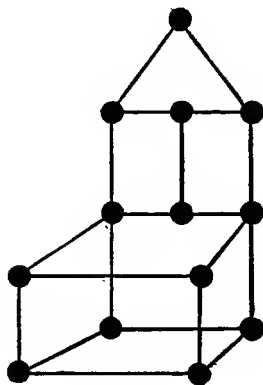
133.



134.



135.



136.

fold this again along the perpendicular from vertex to base. We now have another right-angled triangle eight folds deep, as it were. It is this triangle that is represented in Fig. 137. On the upper face of this we draw a checker pattern, by dividing the base into eight equal parts, and the perpendicular from vertex to base into four equal parts. We now have the auxiliary lines which will enable us to cut as required.

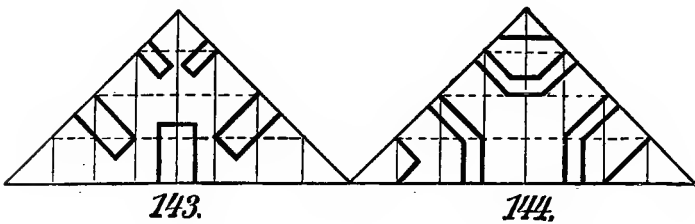
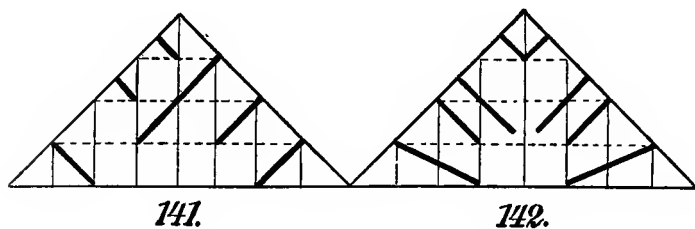
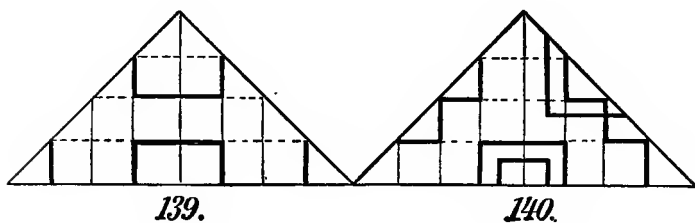
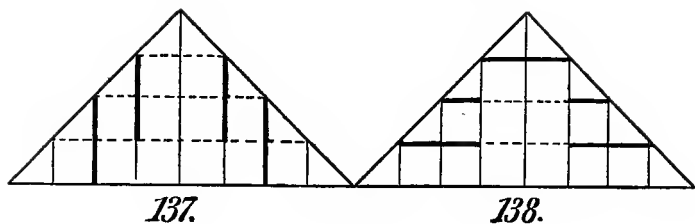
Accordingly as we cut horizontally, vertically, or obliquely into, through, or from the eight-fold triangle, various patterns are produced, which, when mounted, serve as drawing copies, or, at a later stage, as decorations for more elaborate work in paper or cardboard. When the child has made the necessary cuts, it regards the patterns which have resulted with the utmost pleasure and surprise.

The last step is to mount the patterns. If folding be combined with this work, *i.e.* if loose corners be turned in, the number of forms derived will astonish the inexperienced.

Very suitable paper for cutting out and for mounting is either surface paper, or paper coloured on both sides. Kindergarten dépôts generally keep a stock of such papers. The mounted figures are preserved by means of varnish.

To describe the figures, 137-144 exhibit various patterns: 137 shows vertical cuts into the eight-fold triangle, the two end ones extending to the base; 138 shows horizontal cuts; 139 and 140 are examples both of cutting in and cutting off; 141 and 142, of oblique cutting in and cutting off; in 143 we have oblique and vertical cuttings out; in 144 the cuts are more complicated; but in no case can there be difficulty, as the thick lines in the plates are those along which we cut.

Besides the obvious advantages cutting out and mounting possess in connection with drawing and the development of the form and colour senses, they assist in producing immediate perceptions in reckoning, in division, for instance, or in treating of fractions, as also in local geography. Let

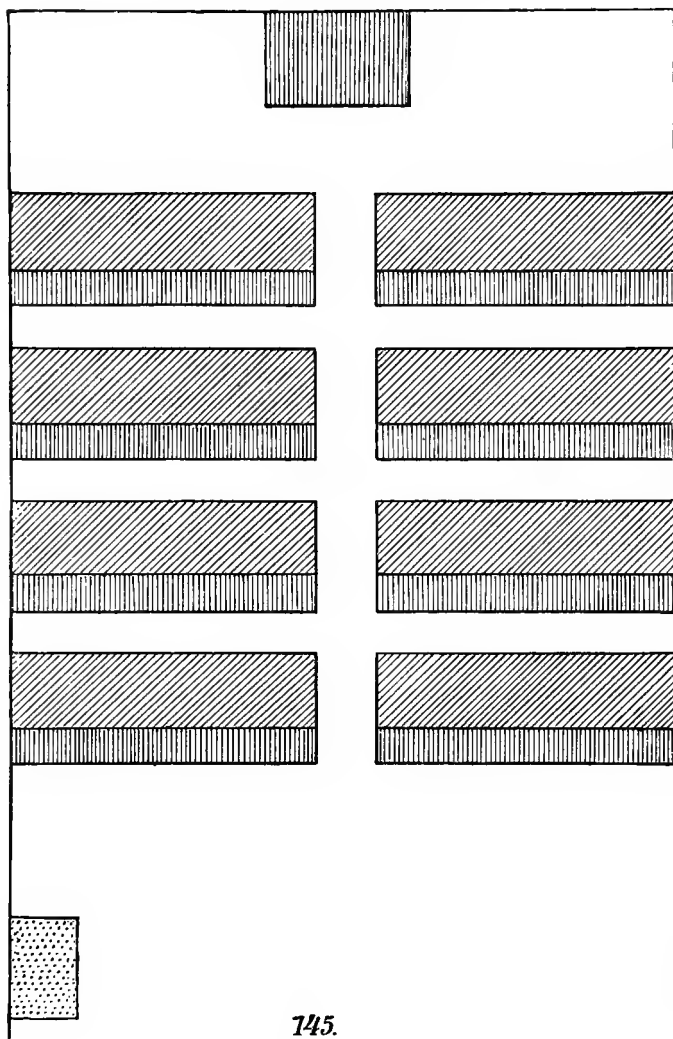


us give an example of the last-mentioned application. It is difficult for a child to comprehend the transition from reality to geographical representation, from schoolhouse, village, or district to the pictures of these on a plane-surface. But the relation is made clear if we proceed as follows :—

When the features of, let us say, the schoolroom have been discussed in regard to length, breadth, height, the arrangement of the furniture, etc., each child receives a sheet of stout white paper in the form of an outline of the ground-plan. Strips of black or brown paper, gummed at the back, are now cut to scale to represent the desks, forms, dais on which the master's desk stands, stove, and so on. These strips are fastened in their proper places on the white sheet. The children now have a complete ground-plan of the room. When this has been drawn on the blackboard, the idea of a map has been fully conveyed. In like manner plans may be made of the playground, village, or a part of the town. Fig. 145 gives the ground-plan of a schoolroom, the shaded spaces denoting the coloured strips attached. The desks may be dark-brown, the stove black, the forms and the dais light-brown.

9. BRIEF REMARKS UPON THE WAY OF CONDUCTING THE DIFFERENT KINDS OF WORK IN THE HOME AND IN THE SCHOOL.

We have thus brought together material for the second school-year as well as for the first. Ample means will be found here to busy and instruct the child, to satisfy its formative instinct and its desire of activity. We hardly need add that the occupations suggested will prove as valuable and entertaining to girls as to boys. Indeed, they are of special importance to the former in view of their subsequent duties as mothers and nurses of children: they should learn that they may themselves teach what they have



learned. As in the school the master assists the boy with deed and counsel, so in the home must mother, sister, or nurse render like help to the little ones under her care, and supply information when it is needed. The raw material used is so cheap that it is within the reach of the poorest, and children who have perhaps to be left without supervision for long hours may, after a few hints, be set to employ themselves with such work as we have proposed. They will thus be saved from idleness and its pernicious consequences, and gain a love of work which will stand them in good stead in after-life.

As regards the school, it will not be found possible to work through every variation of the tasks given. The question is to find in employment, or, more properly speaking, in practical work, a means of furthering the intellectual development of the child and rendering the process of learning more independent. We do not seek to teach *from without inwards*, but rather assist the faculties in developing *from within outwards*. The child must win knowledge by work, not simply receive something presented, and accept the statement of the teacher as to the truth and value of the information. Experience is of more value than belief or mental acquiescence. The course of work pursued must obviously depend not on the *kind*, not on anything inherent in the work, but on the stage of development reached by the learner and on his intellectual requirements. Thus from every department of work we must choose what is most suitable for the workers. It may happen, for instance, in teaching number, that we must have recourse in one and the same day to building with bricks, and folding and cutting out, according as the matter of instruction prompts. But it will readily be understood that in any one kind of work the natural sequence will be observed, that the less difficult will precede the more difficult. There is another rule to be obeyed. It will often happen that certain work is not called for by the subject of instruction in which we are

engaged, but must nevertheless be prosecuted in order that there may be no gap in the development of eye and hand. Thus moulding is one of the occupations at our present stage (second school-year), not because it is in itself requisite, but because it is a connecting link between an earlier stage and more advanced modelling, besides yielding useful *Anschauungsmittel* for geometry.

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III.

Age—eight to eleven. Third and fourth school-year.

FORM-LAYING CONTINUED.

THE FASHIONING OF NEW FORMS WITH TOOLS.

I. BUILDING WITH LARGE BRICK-BOXES.

THE boxes already recommended, manufactured by Fr. Ad. Richter & Co., along with Fröbel's fifth and sixth Gifts, will be found most suitable. They afford material enough for all exercises proper to the present stage, as well as for more advanced work.

The designs given with the boxes enable the learner to construct tasteful, indeed almost artistic buildings. For older boys special architectural plans have been issued. Series of simpler designs may also be had separately.

2. MOULDING WITH PLASTILINA, CLAY, OR PULP.

Although in the following exercises the hand remains the fittest and simplest instrument, yet for the execution of some work we press tools into our service.

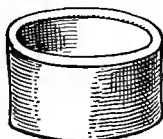
In moulding, the boys should now repeat the most important elementary forms—the sphere, the cone, the cylinder, the cube—and particularly should practise combinations, such as slab and pillar, slab and obelisk. From the blunted cone they should fashion a jar or a cup. The hollowing is effected by turning a knife in the moulded shape. Other



146.



147.



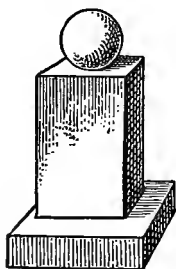
148.



149.



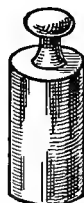
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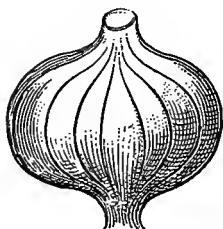
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152.



153.



154.



155.



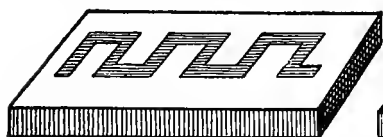
156.

objects may also be represented: for example, the acorn, the onion, the kidney, the vegetable-marrow, the paper-weight, the snail's shell, etc.

We here avail ourselves of a simple modelling tool or tools. The best are made of boxwood, but cheaper ones of plum or apple wood will suffice for our purpose. Figs. 146 and 147 show two forms of modelling tools, which must be about 8 inches long; and Figs. 148-156, a few objects for reproduction in plastilina.

If there is a suitable place for the boys to pursue their occupations, moulding with clay may also be practised. This again has its special attractions. The material is cheap, and thus the objects to be made can be produced on a large scale. It is the common potter's clay, usually sold under the name of modelling clay. To give the mass firmer cohesion and a stone-like appearance, we may mix into it scouring sand—50 grammes of sand to 100 grammes of clay. The clay is beaten up and worked on a roof-slate, a smooth slab, or, best of all, on a modelling-board of hard wood, 6 inches by 8 inches. First the children may make afresh some of the objects already moulded in plastilina; then new objects, especially slabs, upon which decorations are first drawn and afterwards cut with the knife or modelling tool. These slabs are formed by fastening two parallel strips or guides, $\frac{3}{8}$ in. high, on to the modelling-board so that their ends are equidistant; the clay is then pressed between the guides, and any superfluity removed by means of the edge of a moistened ruler. The same process may be followed in moulding tiles or finishing off a house. The slabs will vary in size according to the height of the guides and their distance apart, and can be cut into cubes or pillars. If we mix the clay with sand, tolerably firm bricks may be made, which may be coloured with yellow or red ochre.

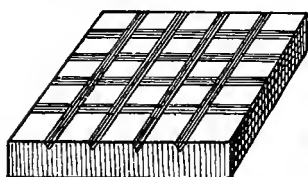
The work just mentioned is naturally suitable only for the more skilful boys, as considerable accuracy is required. Figs. 157-165 exhibit forms for practice.



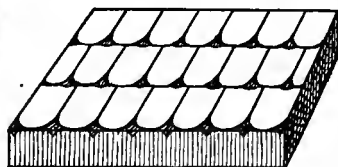
157.



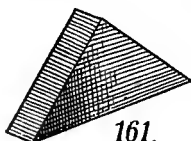
158.



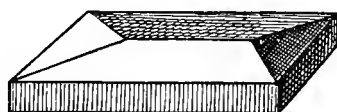
159.



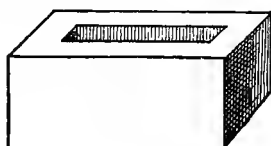
160.



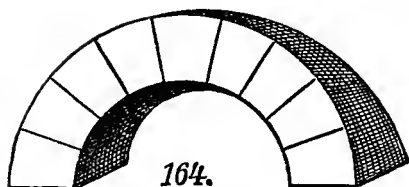
161.



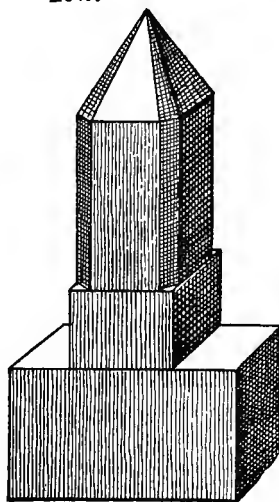
162.



163.



164.



165.

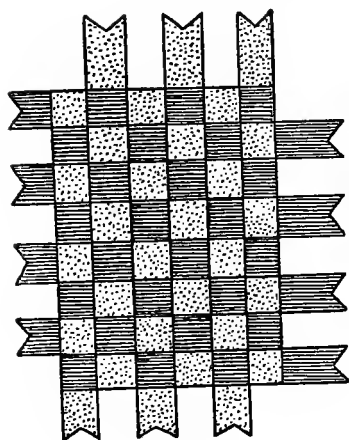
As moulding with clay very often involves the soiling of the clothes, the little sculptors should provide themselves with aprons, and should turn up their sleeves before they begin.

Note.—The removal of the superfluous clay which rises above the level of the guides may also be effected with a roller, such as bakers use; but at present it is desirable to limit the number of tools employed, and to employ the hand as much as possible.

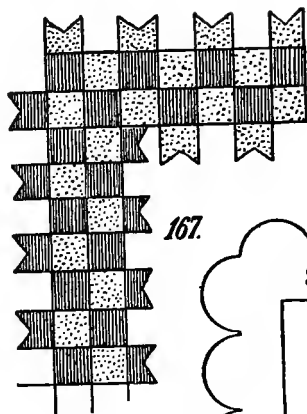
3. WEAVING, FOLDING, AND MOUNTING; CUTTING OUT AND MOUNTING.

The work under this heading is all connected with the corresponding work of the previous stages. Weaving receives an extension, in that all the boys now cut both strips and mats for themselves. The lines to be traced with scissors or knife are first set out with foot-rule and pencil. At first paper of little value is used, scraps of note-paper or the like, and preliminary exercises in cutting are done with the scissors and the knife. As soon as the boys have gained some little experience, mats and strips may be made of surface-paper. Free weaving should, above all, be practised. For this in Figs. 166–168 some pretty patterns are given—a book-marker and two borders for table-mats. The execution is easy, and needs no further explanation. When finished, the woven borders are glued on to cardboard of appropriate shape and colour; the table-mat may also be decorated with an edging of cut paper. See Figs. 169 and 170.

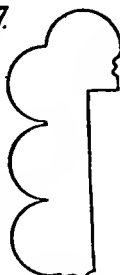
The book-markers in Figs. 171–173 are produced with a strip of glazed or both sides coloured paper, from 4 to 9 inches long and from $1\frac{1}{2}$ to 2 inches broad, which is folded lengthways in the middle. Leaving on the open side a margin (marked $a\ b$ in Fig. 171) of $\frac{3}{16}$ in. or more, we draw lines at an angle of 45° with the edge and $\frac{3}{16}$ in. apart, and cut along them from fold to margin with the scissors. The paper being unfolded, the triangles which have been formed are woven



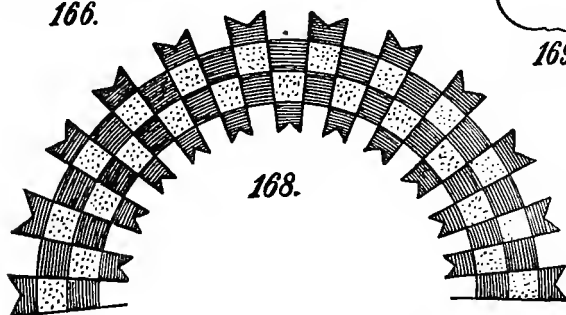
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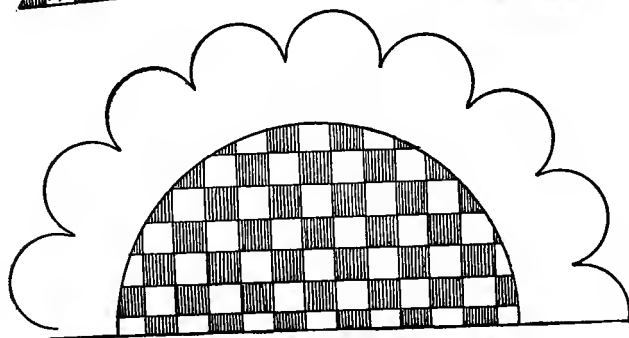
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169.



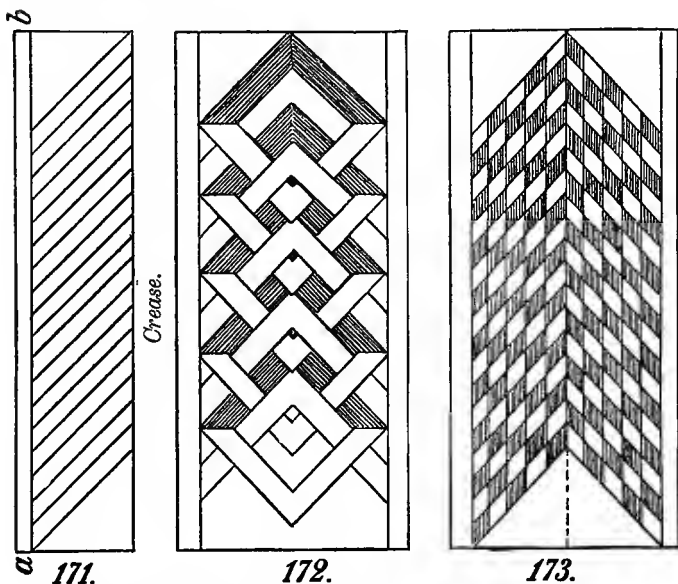
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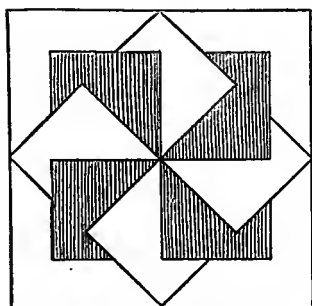
170.

together, one being laid over the other, as shown in Fig. 172. Fig. 173 shows a mat obtained in the same way, but with strips of the ordinary kind woven vertically through it.

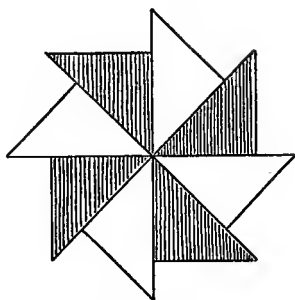
Folding, and folding and mounting, show the same step in advance as weaving, in that all must now cut the folding-sheets for themselves.



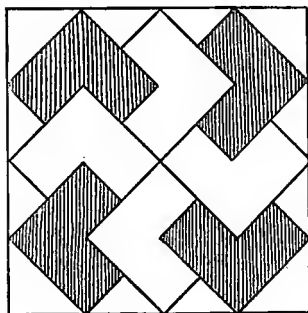
The elementary geometrical forms, the square, oblong, equilateral triangle, regular hexagon, octagon, and circle, will serve as preliminary exercises. These forms are produced in paper of various colours, and combined into numerous patterns which prove useful in the drawing-lesson, and, at a later time, in the decoration of large surfaces. In Figs. 174–179 we give a number of combinations deduced from the elementary forms; additions may be made by the help of drawing. The forms are glued on to coloured paper,



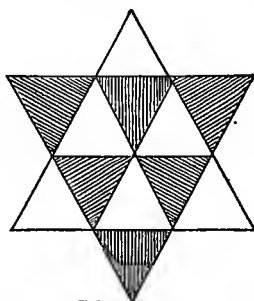
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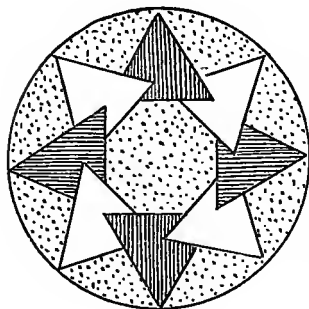
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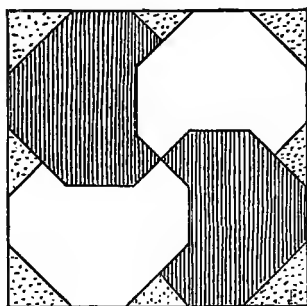
176.



177.



178



179.

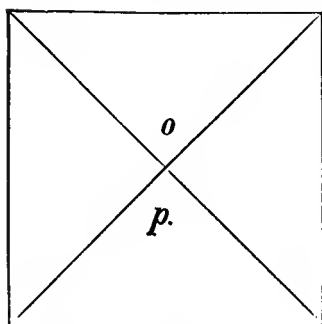
either square or circular in shape. We have here a further use for the tablets, which will serve as patterns.

Folding itself is continued upon the lines of the examples already given (p. 29). The sheet is now folded so often that the letter gives rise to the double letter. This is represented in Fig. 180. If in the same part *o* and *p* are turned over to the middle point of the back, Fig. 181 is produced; the reverse shows the same form.

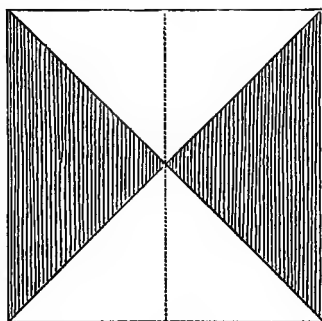
If, after making the single letter, we turn the points of the flaps back to the middle of the sides, then fold the double letter by turning two of the points under to the middle point and two over to the same point, we obtain Fig. 182. If we first form an octagon (p. 30), turn the angular points down on the upper side so that a square results, then fold the corners of this square *backwards* to the middle point, we have a figure one side of which is shown in Fig. 183, the other in Fig. 184. Beginning with the letter form, fold two opposite flaps underneath to the middle point; turn in the points of either pair of flaps to the sides of the square; now make a letter shape by turning two opposite corners to the middle point on the upper side, two to that on the lower side; you will have produced Fig. 185.

It is not advisable for boys to attempt anything very elaborate in the way of folding. They will profit more by making simple forms as neatly and accurately as possible, then mounting a number of small forms side by side in a continuous decoration. Triangular and hexagonal folding-sheets will also give interesting results. Variations are produced by pasting smaller sheets upon larger ones of a different colour, as was illustrated in the preceding stage (Figs. 126-130).

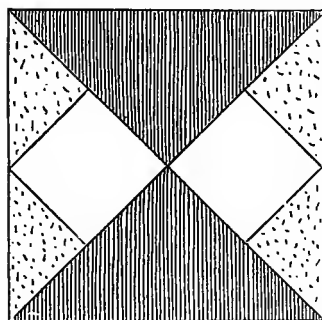
The occupation of cutting out from the thrice-folded square is further pursued, and finds a development in that the cuts are now executed along curved lines. A surprising abundance of new forms is thus revealed to the child. The application of these in drawing is obvious. The figures



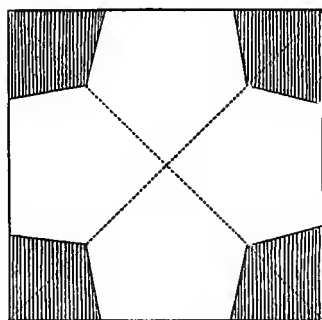
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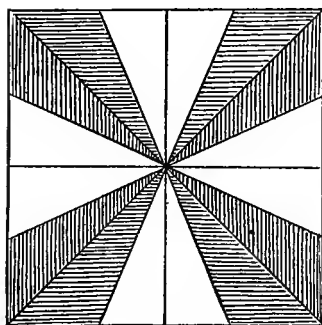
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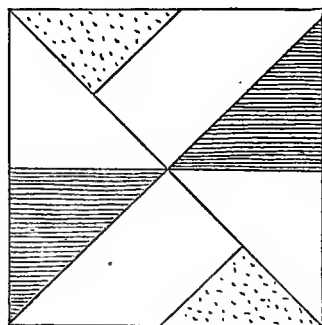
182.



183.



184.



185.

which have been successfully produced may be fastened on a coloured ground. The variety and beauty of the ornaments thus produced incite to renewed exertions. See Figs. 186–191.

More difficult kinds of intertwining may be introduced at this stage, as it is a natural sequence to the occupations of weaving and folding.

The exercises already given may now be followed by those indicated in Figs. 193–198, which are examples of cutting out from the right-angled triangle, once or twice folded (Fig. 192). The boy will here, in particular, learn the value of accuracy in tracing and cutting his lines. The exercises are also useful in conveying ideas of the nature of regular forms and the correspondence of their parts. They also lead to the production of objects of utility, and so impress the learner with the reality of his work and its practical character.

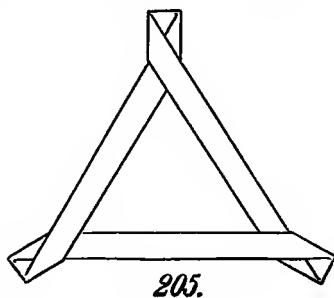
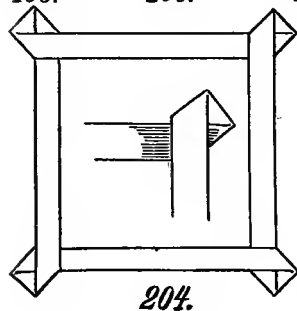
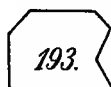
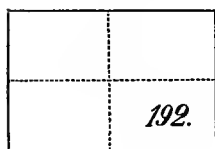
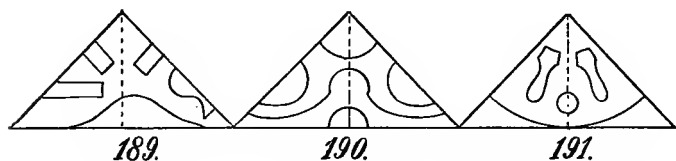
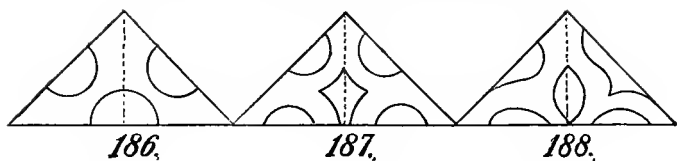
Our sketches are, of course, on a reduced scale. This must be considered when the exercises are being done, and the necessary enlargement must be made.

Figs. 186–190 are to be cut with the scissors; in Fig. 191 the employment of the point of the knife for cutting out finds exemplification.

If squares of thin paper in two different colours are laid one on the other, folded and cut out, then mounted, a sort of parquetry results. All the figures cut out of the sheet should be preserved for decorations, or to be combined into new patterns. The scraps should also be kept, as many of them can be utilised afterwards.

The whole of the figures 186–203 presuppose a certain degree of skill in drawing, and should therefore not be attempted before the fourth or fifth school-year.

Figs. 204 and 205 exhibit an extension of intertwining. The corners of the strips are not merely pressed, but folded into rosettes. The method, easily understood, is described and illustrated by Goldammer (Berlin, 1872), p. 156. Most



suitable for this work is rosette-paper, $\frac{3}{8}$ in. wide. The forms may be multiplied: for instance, two squares can be combined into an octagonal star, two equilateral triangles into a hexagonal star; or the forms given (p. 24) for interlaced slats may be imitated.

4. THE MAKING OF SMALL ORNAMENTS FOR THE CHRISTMAS TREE, AND SIMILAR WORK.

(The chief tool is the scissors.)

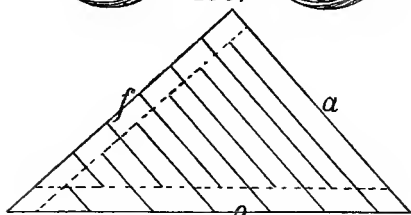
In many English homes, and in all German ones, the Christmas-tree forms the central point of the Christmas festivities. The larger it is and the more handsomely decked, the greater the joy of the children. The shops, it is true, offer material for decoration in embarrassing abundance; but ornaments made by the children's own hands are their special delight. Many pleasing little objects can be produced at a trifling cost. We need but give the boy or girl the necessary guidance.

Fig. 206. **Chain of paper rings.** Strips of wrapping-paper or cardboard, 3 or 4 inches long, and $\frac{3}{8}$ in. wide, are arranged one within the other and joined into a chain, the ends of the bent rings being joined with glue. Gold or silver paper, strengthened by backing with writing-paper, may also be employed.

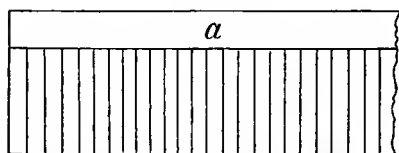
Fig 207 shows us the **Christmas-tree chain**. Take a piece of glazed paper, white on one side, coloured on the other; the length depends on the length of chain required; the width is from 3 to 4 inches. Fold it lengthways in the middle, so that the coloured surfaces are in contact. Draw with a pencil down both edges, the creased as well as the open one, lines to mark off a margin of $\frac{3}{8}$ in. Cut, as shown in Fig. 207, alternately from the right and left to the marginal lines, making the cuts $\frac{3}{8}$ in. apart. Now unfold the sheet and draw out the chain. Children should be cautioned to exercise care in performing this last operation



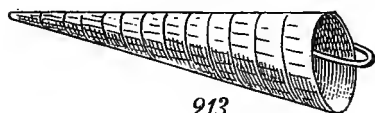
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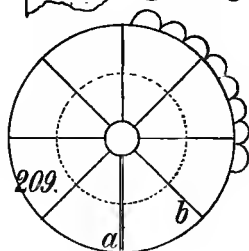
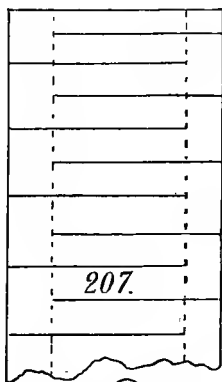
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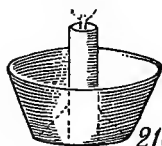
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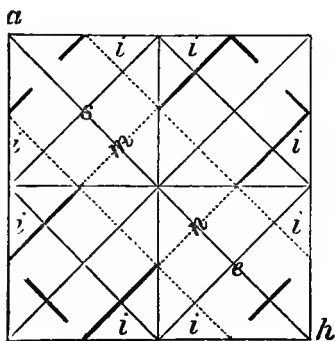
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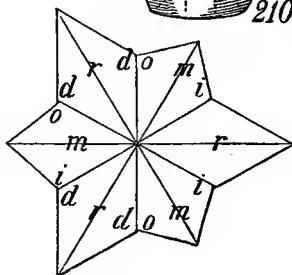
209.



210.



211.



212.

especially if the paper be thin; otherwise the chain will break. If the paper is folded twice instead of once, we find on unfolding that a double chain has been produced. The white sides of two different kinds of coloured paper may be pasted together, and the procedure given above adopted.

Fig. 208. The apple-net or nut-net. For the former we use wrapping-paper in the form of a square with a 6-inch side, for the latter glazed paper, square and with a 3-inch side. The original square is folded along one diagonal into the form of a right-angled triangle, then along perpendicular from vertex to base into a smaller right-angled triangle, then once more in the same way (see Fig. 137). The open side of the fold is at *a*. Margins are marked off, indicated in the diagram by dotted lines. Then cuts are made alternately from *o* and *f*; these are all parallel to *a*, and distant from one another about $\frac{3}{16}$ in. Unfolding the sheet, we place in the middle an apple or a nut, as the case may be; the square is then lifted by the corners, and resolves itself into a net. The ends are joined by a ribbon, and the net may then be hung on to the tree. It is worth noting that in unfolding cut patterns a paper-knife or bookbinder's-stick will be found very useful.

Fig. 209. Candle-guard. This may be made of coloured tissue or glazed paper, cut into strips, $2\frac{1}{2}$ in. \times 9 in., which are folded lengthways. The margin *a* is set off on the open side, and is from $\frac{3}{8}$ in. to $\frac{9}{16}$ in. wide. Parallel cuts, $\frac{1}{12}$ in. apart, are made from the creased edge to the margin. The sheet is not unfolded, but the marginal edge is wrapped round the bottom of the candle and the ends are glued together. The fringe is pressed down a little with the fingers.

Fig. 209 (in the circle) shows a candle-guard in bowl or candlestick form, which catches wax or stearine drippings still better. After cutting from wrapping-paper or cardboard a circular disc, $3\frac{1}{2}$ inches in diameter, we divide it into eight equal parts. These divisions can easily be obtained by folding a thin sheet of the same size three times and marking off

the points required. At *a* we cut towards the middle of the circle and make there a hole of the same size as the candle. We now cause the eighth part to overlap the first so that *a* falls on *b*, and glue the overlapping parts together. The result is a sort of funnel. If we wish for the form shown in Fig. 210, the bottom of the funnel must be pressed upwards.

Fig. 211. **Sweet-box.** For this pretty toy we need a piece of thin cardboard, 8 inches square. Fold the letter, then unfold; put *a* on *e*, and so fold in *m*; unfolding, put *h* on *s*, and so fold in *e*; deal in the same way with the two other corners. The sheet will now be found to be marked with a checker pattern. Flatten, but not so as to obscure the lines, and cut out the eight triangles marked *i*; then make the ten cuts indicated in the diagram by thick lines. Lastly, bend so that the four inner squares represent the bottom of the box, and latch together the upper flaps. A closed box will have been produced.

Fig. 212. **A nut-holder.** On a square piece of paper with a $4\frac{1}{2}$ -inch side draw a line $\frac{3}{4}$ in. distant from one of the sides and parallel to it. Starting with this line, describe an equilateral triangle with a $4\frac{1}{2}$ -inch side. The three sides of the triangle are halved, and each half divided into three parts. The angles of the triangle are bisected, and each bisecting line produced to a distance equal to one of the thirds of the half-sides. The outline of the figure is completed and cut out. Crease the back along *m*, so that *i* falls on *o*. Place the nut in the middle, and gather the three short star points together by means of a thread. Or crease along *r*, so as to bring *d* on *d*, and gather the longer star points together. This produces a somewhat different shape. It will be noticed that there are three *r*'s; so that crease along *r* means crease three times, once in each direction indicated.

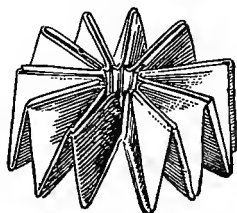
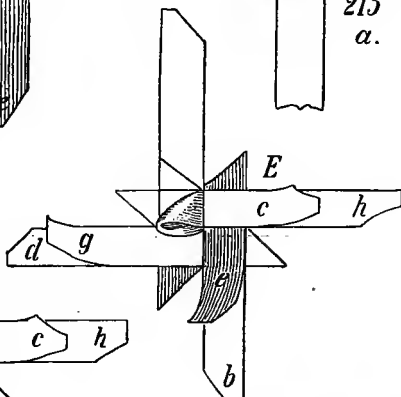
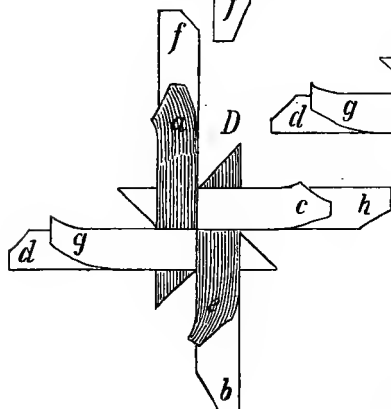
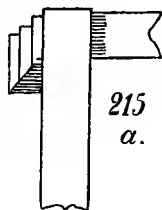
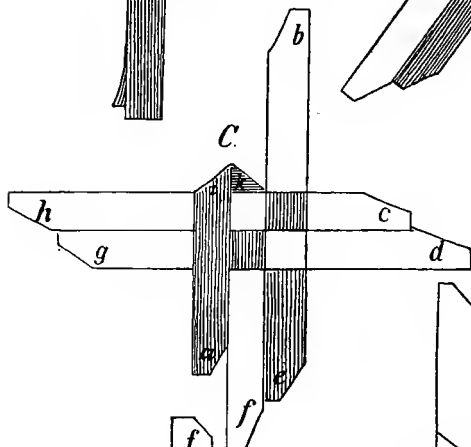
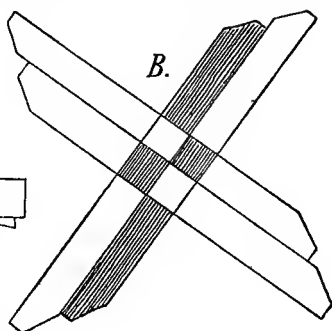
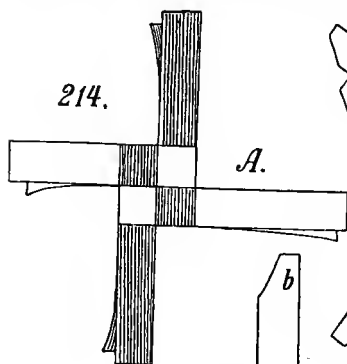
The best colours for Christmas-tree ornaments are yellow, red, and green, as the effect of these is not impaired by the light.

The little baskets to be mentioned later on also form pleasing decorations for a Christmas tree, especially if worked in suitable colours or with gold paper.

Fig. 213 shows a **small paper bag**, like those in which sweets are sold. As in the shops, the bag may be made by simply twisting the paper into a conical shape, the overlapping edges forming a rough join. But it will be better to secure them with glue. If the bags are to be hung on the Christmas tree, use silver or gold paper, fill with sweets, and attach by means of thread or narrow ribbon.

Fig. 214. **The Christmas-tree star.** We take four narrow ($\frac{3}{16}$ in. to $\frac{9}{16}$ in. wide) paper strips of two different colours (gold and silver paper will serve), fold them together in the middle, and interweave them on the *round and through* principle, as shown in Fig. *A*. We then point the ends with the scissors, that they may go through more easily. Taking the four upper strips, we bend them back and plait them together. Every two strips are now lying side by side (Fig. *B*). From each of these eight strips one of the points of the star is formed. As we work we turn the strips round, so that the strip from which the point is to be formed is upwards. Thus in Fig. *C* we begin with strip *a*, crease it by bending it over towards *h* and *g*, and then again by turning it over and laying it next to *f* and *e*. If *i* is folded on to *k*, the first point of the star has been formed. It is secured by passing the end of strip *a* through near *k* and drawing tight. To form the second point of the star, turn the work round so that *c* and *d* are upwards, and crease and fold as before. In this way we form four star points; we then turn the whole over, and develop star points from the remaining four strips, beginning with strip *h*. With the ends of the strips trimmed off, the star even in its present form may be used to deck the Christmas tree. But we can add another attraction in the shape of eight little bags such as are shown in Fig. 213, four on each side of the star. Before proceeding to do so, we bend the four strips

214.



on the upper side (a c e g) back, and place the whole so that strip *a* is upwards (Fig. *D*). We next bend strip *a* downwards to lie next to *b* and *e*, take it by the end, turn the end over *g* and *d* and thrust it under strip *c* so that it comes out under *c* between the points of the strips. Fig. *E* illustrates the process of forming the first bag. Should it be found difficult to pass *a* under *c* as required, we may use the point of a knife or of the scissors to thrust it through. The other bags are made in the same way. Superfluous ends are cut off, and the star is ready for the tree.

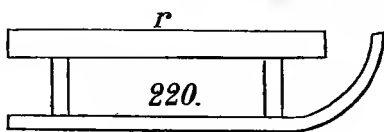
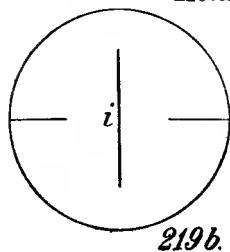
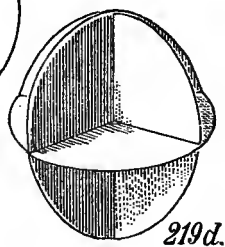
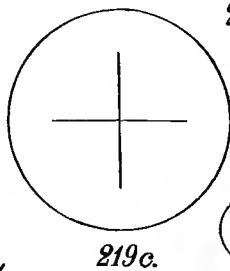
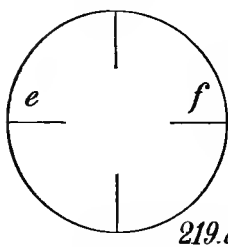
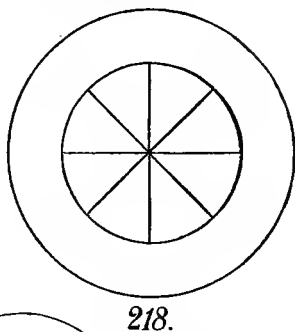
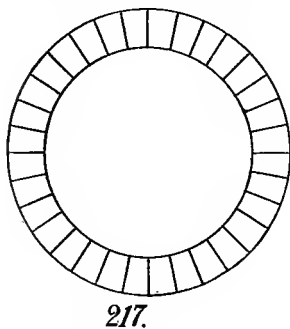
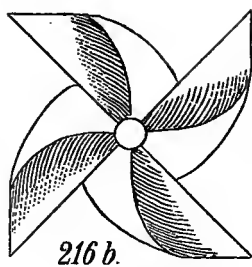
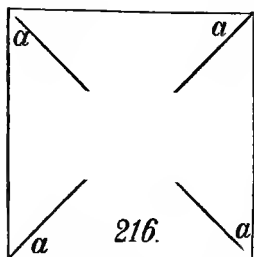
Fig. 215 *a*. **The concertina.** Cut paper or thin cardboard into strips, $\frac{3}{8}$ in. to $\frac{1}{4}$ in. wide, and from 8 to 12 inches long. The ends of two strips are joined at right angles, and strip folded over strip alternately. The ends are secured with glue. This is a very easy piece of work, which even younger children can do. It is developed in the next exercise.

Fig. 215 *b*. **Another star.** Bend the ends of the concertina round so that it forms a ring, and join them together with glue, and a star like that drawn in the plate results, which can also be used for decorative purposes.

As we have said, the delight of the boy in his own creations is far greater than any purchased tinsel can give. He now begins to see that his work is real, and any tendency to despise it disappears.

SMALL PLAYTHINGS.

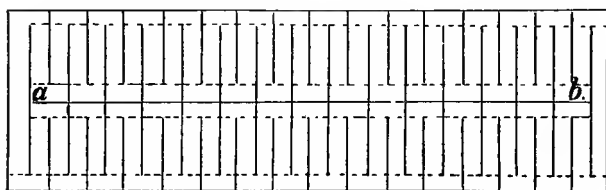
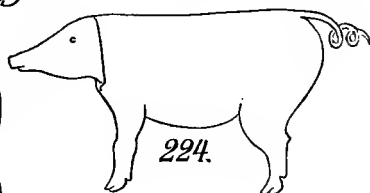
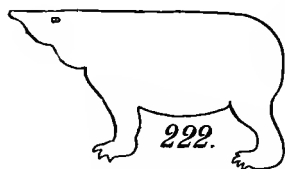
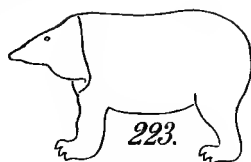
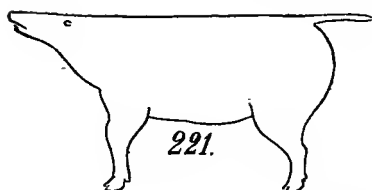
The windmill (Figs. 216 and 216 *b*). A sheet of glazed paper, from 4 to 6 inches square, is folded in the direction of the diagonals. Unfolding it, we cut along the diagonal creases as shown in Fig. 216, each cut being in length about one-third of the whole diagonal. The four tips marked *a* are bent over (not *folded*) on to the intersection of the diagonals, and fastened there with a pin or small nail. Several of these windmills may be fastened on a stick or wooden framework. The four tips in the middle can be hidden by means of a small cardboard disc of a different colour.



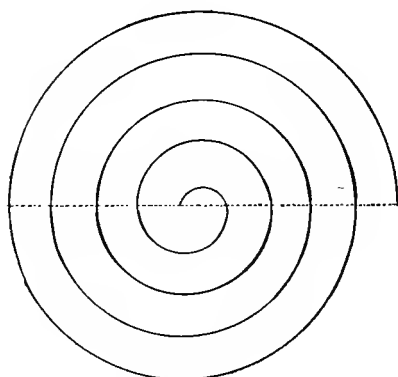
Wind-wheels (Fig. 218). On a piece of cardboard or thin "wood-pulp" is traced and cut a circle of $2\frac{1}{4}$ in. radius. In this circle a circle with the same centre is described, having a radius of $1\frac{1}{2}$ in. The inner circle is divided into six, or (as in the diagram) into eight parts (sectors). The opposite points of division are joined by lines. Along these lines we cut, making first a small opening at the centre with the point of the scissors. The tips at the centre are bent alternately to the left and to the right.

Fig. 217 shows another form of wind-wheel. We describe the inner circle $\frac{1}{2}$ in. from the outer. From outer to inner circle we trace lines (32 in Fig.) directed to the common centre; these are, on the outer circle, about $\frac{3}{8}$ in. apart. We then cut along these lines, from the outer to the inner circle. The resulting divisions are bent, as before, alternately to the right and to the left. In divisions of this kind we must always take care that the number is even; otherwise the folding cannot be symmetrical.

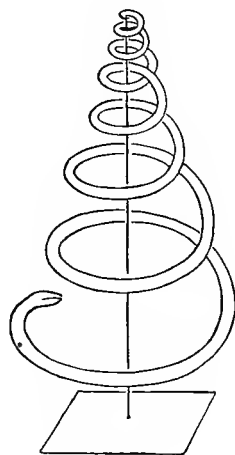
[It may perhaps be asked how we can make our thirty-two divisions of equal size. One method obviously is by folding, which is a useful practical means of obtaining many geometrical results. Thus, if the pupil has to trisect a line, let him take a strip of paper of the same length as the line, and fold it in two creases so that the free ends are at different sides. An angle may be trisected in a similar manner (see Fig. 346). Many other applications of folding will suggest themselves to the expert teacher. If, for instance, the learner should need a circle, the teacher might describe it for him with the compasses; but this would be against the principle that the boy must do the work for himself. Let the pupil take a sheet of thin paper once folded, and cut a rude semicircle; then let him fold radially as often as possible, and cut an arc along the open edge. After a little practice he will be able to produce a circle true enough for ordinary purposes.]



225.



226a.



226b.

The wind - ball (Figs. 219 *a-d*). Trace out three discs, *a, b, c*, $2\frac{1}{4}$ inches in diameter. Cut as in the several plates *a, b, c*, the length of the cuts being rather more than half of the line cut. Pass the upper part of the disc *a* through the slit *i* in *b*. To do this it will be necessary to press the ends *e* and *f* together. Now pass the upper part of the cross-form (two circular planes at right angles to each other) which has been produced, through the cross-slit in *c*. Here again we must bend the parts to be inserted backwards, so that they may pass easily through the slit. Fig. 219 *d* shows the wind-ball in its finished state.

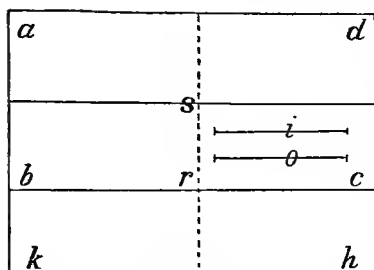
Fig. 220 represents a **sledge** made from a folded sheet of strong paper, the crease being along *r*.

Figs. 221 and 222 are outlines of two **beasts** made in a similar way.

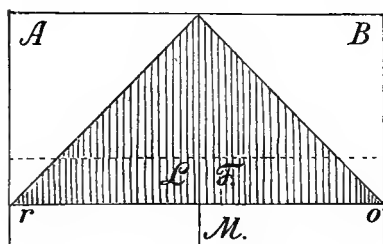
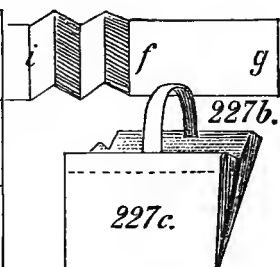
The beasts drawn in Figs. 223 and 224 are first made without heads, also from a folded sheet. The heads are cut out separately and gummed on to the bodies, or they may be attached by means of a thread, so as to be movable.

Fig. 225. How a boy may creep through a common playing - card. This is an easy trick. Fold the card lengthways along *a b*. Cut alternately from the crease and from the open edges to the dotted lines. Make the cuts as close together as possible, say about $\frac{1}{8}$ in. apart. Unfold; cut not the whole length of the crease, but from *a* to *b*, and draw out. You will find that a child, or even a man, can easily pass through the ring produced.

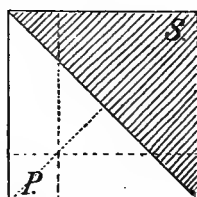
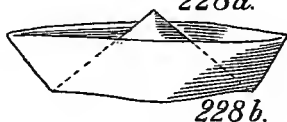
The dancing serpent (Figs. 226 *a* and 226 *b*). A spiral, such as is shown in Fig. 226 *a*, is cut not according to any geometrical construction, but by the unguided hand. Several attempts will probably be necessary before a satisfactory result is obtained. The paper is turned with the left hand. The part which is to form the serpent's tail should be left somewhat broad, in order that it may be fastened on a knitting-needle, about which the serpent hangs in a coil. The needle is fixed in a small block of wood. Placed on a



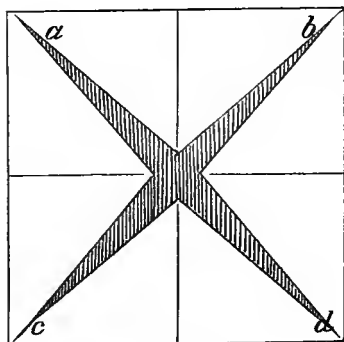
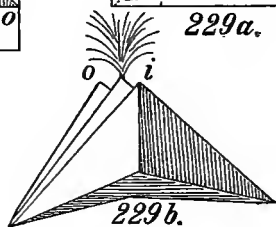
227a.



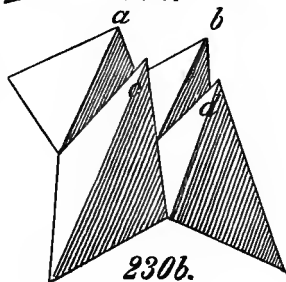
228a.



229a.



230a.



stove, the serpent will revolve about the needle, in consequence of the rising heat.

Hand-bag with handle, made with two pieces of paper (Figs. 227 *a-c*). We take a rectangular piece of paper, about 8 in. by 6 in.; lay one third, *a d*, on the middle third, *b c*, and fold *k h* over on to the other two thirds, *a d* and *b c*. We then unfold the paper, and draw with the point of the knife in the middle of the right half two cuts, *i* and *o*, which extend to 1 cm. from the middle line, and 2 cm. from the outer edge. These cuts produce the handle. We now fold as before, and thrust the side at *b* into the opening at *c*. Pressing the sheet flat, we fold along *r s* so that the handle is inside. We have thus far obtained the two sides of the bag joined by the handle, which is lifted up. We next take a strip of paper rather narrower than the sides of the bag, and about three times as long. This is to form the ends of the bag. At one extremity we crease it (*i f*, Fig. 227 *b*); fix the part towards *i* in one of the slits at the right side of the bag, then pass the free end through the other of those slits to the left side. Here we crease as before, and secure the end in the unoccupied slit of the left side.

Fig. 227 *c* shows the hand-bag completed.

The cocked hat (Fig. 228 *a*). A rectangular piece of wrapping-paper or newspaper, fairly large, say 15 inches long and 9 inches broad, is doubled, then folded as indicated in Fig. 228 *a*; that is, so that *A* is brought on to *L*, and *B* on to *F*. The upper piece of the margin *M* is turned up, the lower folded back, and the ordinary cocked hat is produced. Lay the front point *o* of the hat on to the back point *r* by pressing the hat together. The square shown in Fig. 229 *a* is the result. At *P* there are two free points; fold one of these backward, the other forward on to *S*, and you have the **three-cornered hat** drawn in Fig. 229 *b*. The middle point may be decorated with a few feathers, or a tuft made of shreds of paper. [*Note*.—In doubling at the outset, fold

along the breadth, so that the rectangle resulting is 9 by $7\frac{1}{2}$ inches. *A B* is the folded edge.]

The boat (Fig. 228 *b*). If we draw out corners *i* and *o* of the three-cornered hat, and fold the middle corner in half, we have the shape of a boat.

Nut basket (Fig. 230 *b*). From a square folding-sheet (6-inch side), letter-shaped as in Fig. 230 *a*, we can easily form Fig. 230 *b*, by bringing together the corners *a b c d*. These four corners are turned underneath, and joined by means of a thread. We are thus enabled to form a pretty little basket for four nuts, which can be hung by a thread to the Christmas tree.

To the playthings, the construction of which has been described, might further be added : banners and streamers, small kites, rosettes, and borders. The two last-mentioned decorations may be made of fragments. We therefore repeat the caution not to throw away the figures which fall out as coloured paper is cut, but to preserve them for use at a later time.

5. CARDBOARD-WORK.

Baskets and boxes produced from simple ¹ geometrical plans on the flat.

The tools employed are the scissors and the knife. A sharp-pointed steel paper-knife is used for the purpose. If the boy can draw accurately, using the ruler as a guide, he should now learn to cut along the drawn lines with the point of the knife. The best rulers are of iron ; they can be obtained from the publishers.

The other tools—the compasses, the lead-pencil, the foot-rule or measure—have already been in use. To measure distances it is perhaps better in the earlier stages to adopt the foot-rule. If the diagrams show centimetres and millimetres, the reduction is easily effected by reckoning the

¹ Plane projections, technically known as nets.

centimetre as $\frac{3}{8}$ in. When the learners have made some progress, they may work according to the metric system. For a cutting-board an ordinary hardwood board will suffice. One about 12 or 15 inches long, 8 inches broad, and 1 inch thick, is all that is requisite of this kind at the present stage. To join the different parts of the work we employ glue. The glue-pot consists of an inner vessel, supported in a water-bath, the object of which is to prevent the glue from burning. The bottom of the inner vessel is best made of zinc; otherwise it is apt to rust. As the glue-pot is a common object in most households, or can be obtained at a moderate price, it is not desirable to seek any substitute for it. It is most important that the glue used should be good. Russian or Scotch glue is recommended. The former is white, does not so readily leave streaks on the outside of the work, and cements very firmly. Before use the glue is soaked in water for ten or twelve hours, and then warmed, not boiled. Fine brushes are needed. The learner must be reminded that glue is not laid on thick, but spread thinly and evenly over the surface to be joined. A thick mixture is required for cardboard-work, a thin for paper.

The exercises in cardboard-work which now follow, afford an unusually rich store of novel and attractive forms. Developed from simple geometrical patterns drawn on the plane, they nourish and stimulate the formative impulse in the child.

To procure the squares required, the best plan is to take a large sheet of cardboard, 18 in. by 24 in. This we can cut into twenty squares, each with a $4\frac{1}{2}$ -inch side. There remains a strip, $1\frac{1}{2}$ in. by 18 in. It will be seen that in cutting the squares we begin by dividing the 18-inch side of the sheet into four equal parts. The strip left over serves for making the requisite handles. The size of the squares ($4\frac{1}{2}$ -inch side) is suitable for the scale on which we construct the various objects, and also convenient for division into parts.

The different lines in the diagrams indicate—(1) The pattern drawn on the plane ; (2) an alternative shape ; (3) lines to be scratched so that the cardboard will bend ; (4) lines to be cut.

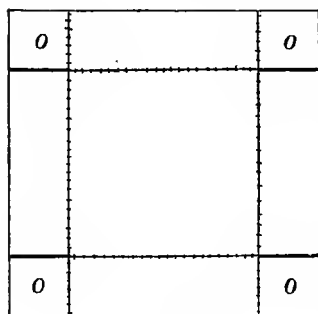
Observations on the Several Figures.

Fig. 231 *a* shows the simple box shape, consisting of a flat bottom and four sides, the whole produced from one square of cardboard. The height of the sides is $\frac{3}{4}$ in. The cutting is done with the scissors, the scratching with the point of the knife. The latter operation must be very cautiously performed ; the scratch must only be through half the thickness of the paper. The inner square is the bottom of the box. When the sides are turned up, the overlapping pieces *o* are used in glueing the sides together. So it is in the subsequent tasks ; they must, therefore, not be cut off.

Fig. 232 is formed from a rectangular piece of cardboard, $4\frac{1}{2}$ inches long, 3 inches broad, and represents the construction of a long box. If we proceed as in the case of the square box above, and cut along *a*, whilst we scratch as before, the sides will be perpendicular. Cutting along *b b* at the four corners, and scratching along the sides of the inner square, will make the sides oblique. In the second case, the points which, after the glueing of the sides, rise above their level, are cut off.

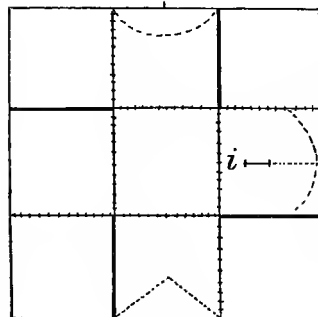
Fig. 234 contains the pattern for a box with perpendicular sides, and for one with oblique sides. The construction depends on the division of the sides of the square into four equal parts. This division is effected by means of the diagonals. The method of proceeding is then the same as in Figs. 231 and 232. Corresponding views of the boxes are given under the same numbers with *b* appended.

Fig. 233 shows four different forms, depending on the division of the sides of the square into three equal parts. The centres of the concave and convex arcs lie in *i*. When the frames of the baskets have been completed, handles are attached.

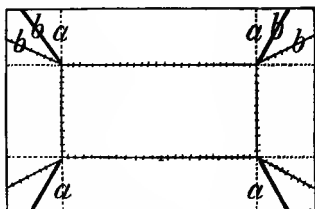


231a.

i

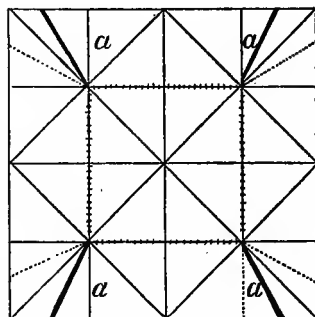


233a.

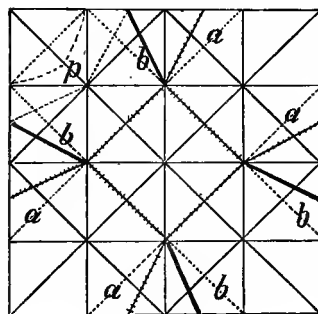


232

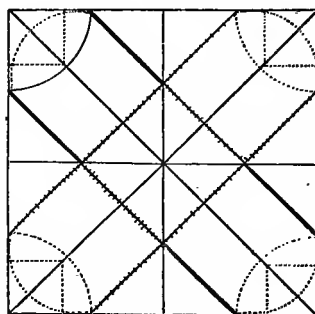
- Plan.
 - - - - - Alternative shape.
 + + + + + To be scratched (scoring).
 ————— To be cut.



234a.

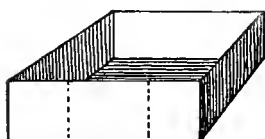


235a.



236a.

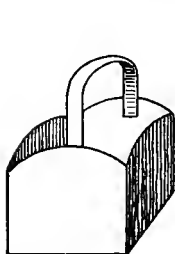
Fig. 235 gives the pattern for a number of variously shaped baskets, the primary idea being the division of the sides of the square into four equal parts. According as we leave the points, cut them out or cut them off, round them concavely or convexly, we can arrive at six or seven different



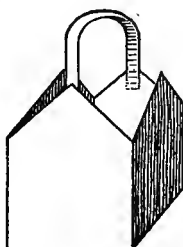
231 b.



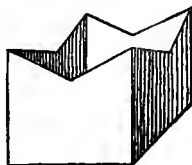
234 b.



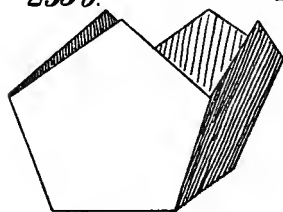
233 b.



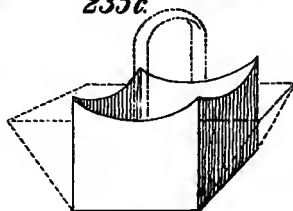
235 b



235 c.

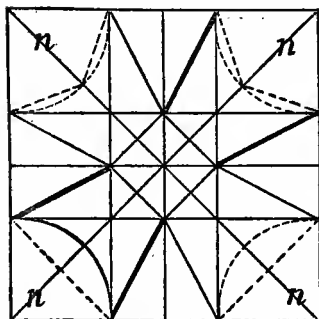


235 d.

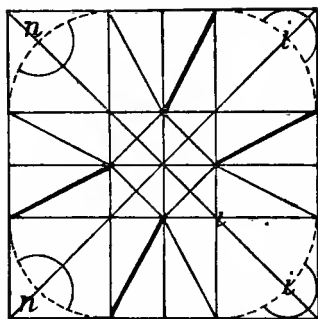


236 b.

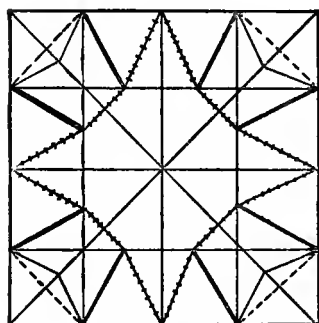
shapes. The cuts into the pattern are always to the same points. At *p* we have indicated the various possibilities, the cuts would have to take place at *b*, the scoring to assist the folding at *a*. Figs. 235 *b-d* give several forms of basket produced from this pattern.



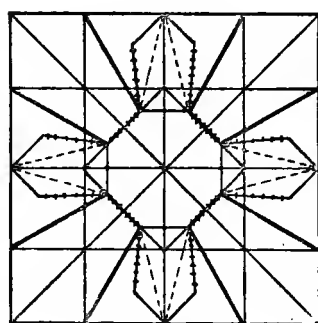
237.



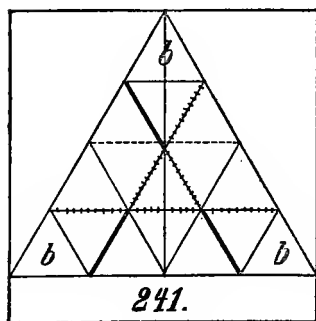
238a.



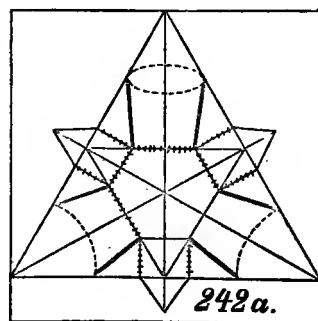
239a.



240a.



241.



242a.

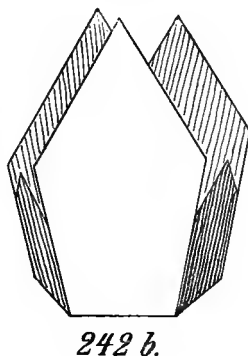
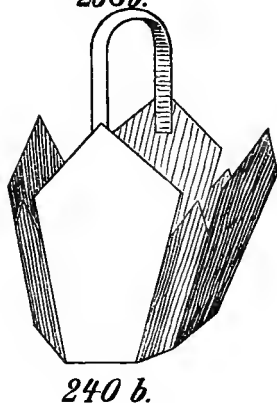
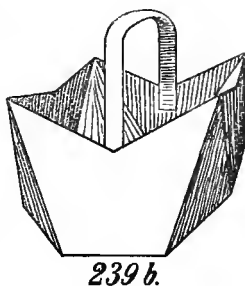
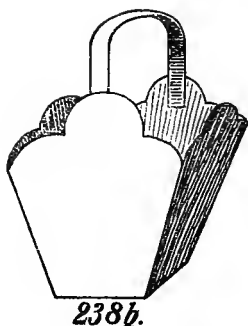


Fig. 236 has also the fourfold division of the sides and middle lines as a basis. Here again various forms are indicated.

The small pieces which result from cutting out or cutting off should be arranged into figures and mounted on sheets.

If when the basket derived from Fig. 236 *a* has been formed, the sides are drawn out to the right and left, as is indicated by the dotted lines in Fig. 236 *b*, so as to slope a little, we obtain a pretty hand-basket, to which we attach a suitable handle.

Figs. 237 and 238 *a* arise from the division of the sides of the square into three equal parts. The centres of the arcs in Fig. 238 are in *i*. The pieces marked *n*, of course, fall off. Fig. 238 *b* gives a view of the basket with the tops of the sides doubly curved. The handles should be made about 5 inches long.

Figs. 239 *a* and 240 *a* depend on the fourfold division of the sides of the square.

Figs. 239 *b*, 240 *b*, exhibit the forms of basket produced from patterns 239 *a* and 240 *a*. These forms may be varied, as before, according as we round the corners concavely or convexly, cut in or cut off.

Figs. 241 and 242 *a* give several shapes developed from the equilateral triangle. The latter is cut from a square of $4\frac{1}{2}$ -inch side, as is shown in Fig. 241. From Fig. 241 we can obtain a tetrahedron as well as a three-sided box. Fig. 242 *a* shows the ground pattern of various baskets, one of which is drawn in Fig. 242 *b*.

Figs. 243 *a* and 244 are based, the former on a hexagon, the latter on an octagon inscribed in a circle. According as we measure off smaller or larger distances from the corners, the sides of the baskets (or rather, trays) will be oblique or perpendicular. The size of the bottoms can be varied at will. Fig. 243 *b* gives a view of a hexagonal basket.

Fig. 245 *a* shows us how to form a kind of "sweet-bag." It is made by dividing a semicircle into four equal parts and glueing the first over the fourth. A handle is then attached. From Fig. 245 *a* we also obtain 245 *b*.

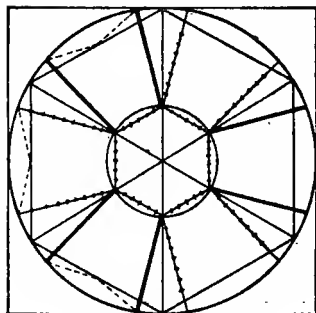
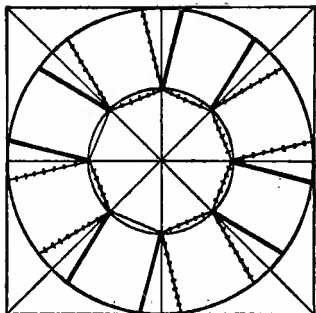
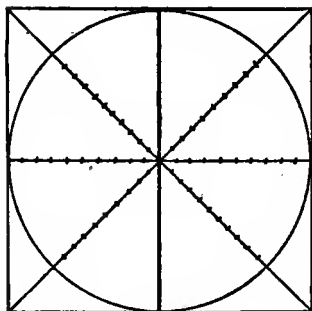
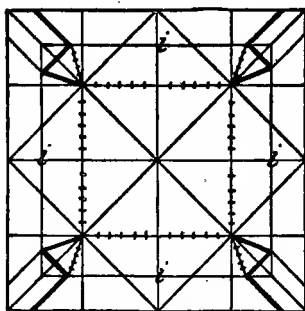
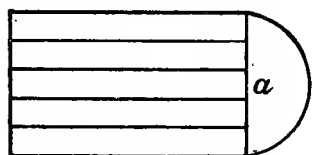
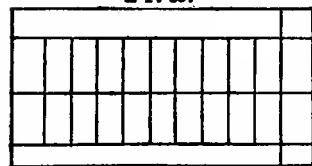
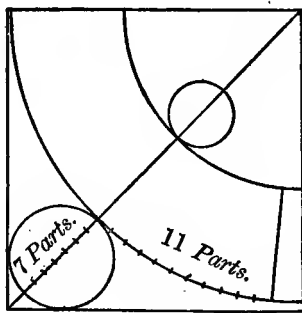
Fig. 246 (*a* plan, *b* object) is a tray with sloping sides and horizontal edge. This edge is formed by folding backwards along *i*. After glueing we cut off the projecting points.

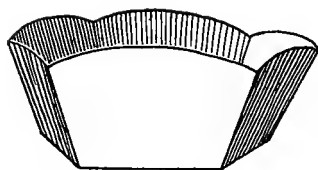
To make the plaited heart drawn in Fig. 247 *b*, we take two strips, each $5\frac{5}{8}$ in. by $1\frac{7}{8}$ in., of different colours; for instance, blue and orange, or red and green. Each strip is folded breadthways, and cuts are made $\frac{3}{8}$ in. apart from the

closed edge to the margin *a* (see Fig. 247 *a*), which is rounded off. We have thus formed two weaving mats with five strips each. Beginning at the upper end, we weave these two mats together on the *once round, once through* principle, explained under free weaving. We thus arrive at the heart-shaped figure shown in 247 *b*. If we add a handle, we have a pretty little bag, which will serve to deck the Christmas tree.

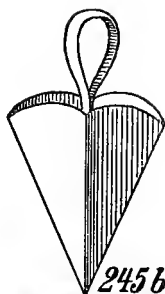
Figs. 248 *a, b, c*, and 249 *a, b*, show the formation of cylindrical and conical baskets with woven or curved casings. The method of fashioning them is clearly enough indicated by the diagrams. To make Fig. 248 *c*, the paper 248 *a* is folded in the middle line before the glueing takes place.

The application of the woven mat to basket-making is illustrated by Figs. 250 and 251 *a, b*. Take any woven mat you please (Fig. 250), cut out at the corners (*a b c*), and crease in *d* to form the bottom of the basket. Fasten the corners by narrow ribbons. You will have a pleasing card-basket. Fig. 251 *a, b* is also a pretty design. To do the work, cut a weaving mat, 6 inches long and $4\frac{1}{2}$ broad. Mark off points $\frac{3}{16}$ in. apart, and cut the mat in the way already known. Weave in strips of the same breadth ($\frac{3}{16}$ in.). Then secure the ends of the strips with glue, and cut off any ends of strips which project beyond the margin. Then count at each corner six strips from the longer side, and the same number from the shorter, and cut in from the shorter sides to the points so obtained. Turn up perpendicularly both the shorter and the longer sides. The projecting parts of the longer sides are bent at right angles, brought within the shorter sides, and fastened to them with glue. It is now necessary to form a handle. A narrow strip of cardboard with a gold edging is bent over the basket and joined to the middle of each of the longer sides, also with glue. To give the basket a more finished appearance, we may further trim the outside of the rim with a gold edging.

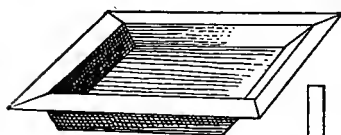
**243 a.****244.****245 a.****246 a.****247 a.****248 a.****249 a.**



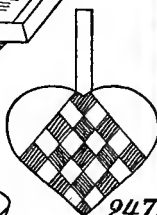
243 b.



245 b.



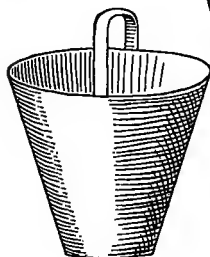
246 b.



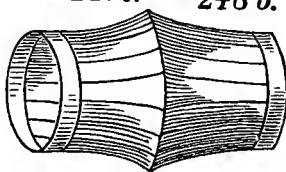
247 b.



248 b.

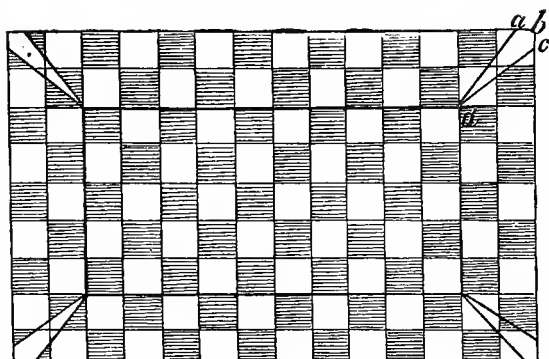


249 b.

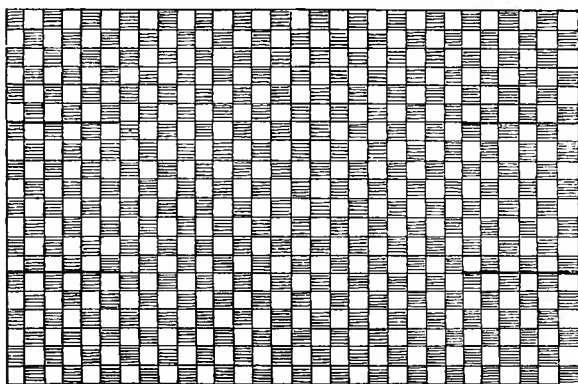


248 c.

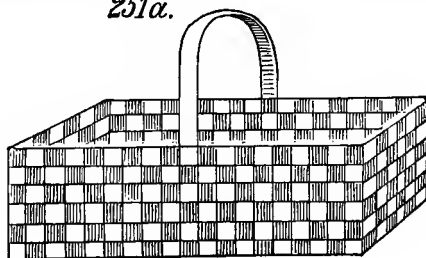
The making of flower-pot screens and lamp-shades. To make a flower-pot screen, we first cut out of a piece of thin cardboard a pattern, such, for instance, as Fig. 252 or 253. This is laid on a sheet of the same kind of cardboard; the outline is traced with a pencil and cut out. Or we may cut pieces of cardboard to a suitable size, fold them in the middle, and lay the pattern, likewise folded, upon them. This procedure has the advantage that the two halves of



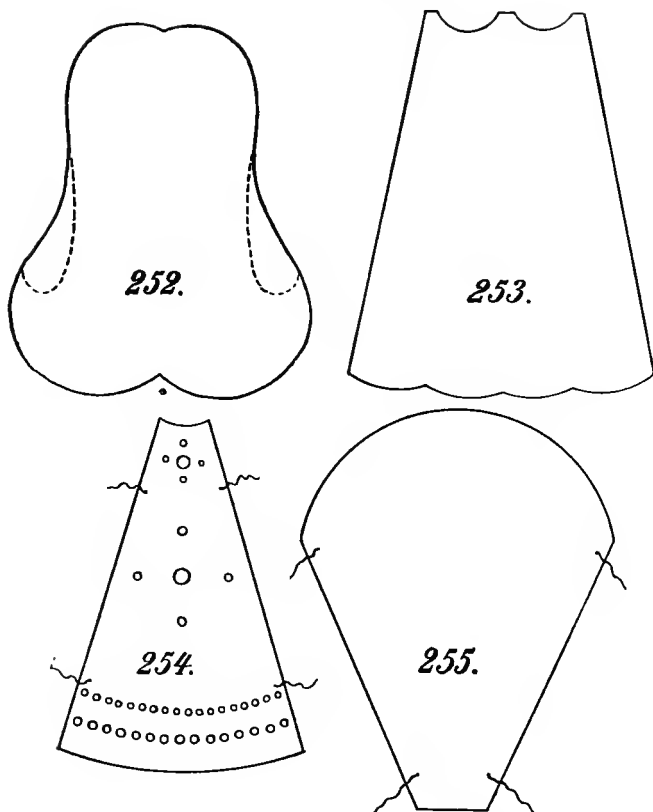
250.



251a.



251b.



each part must correspond exactly. Having made from paper of various colours some eight or ten equal parts, we lay them so that the creases lie one above the other at the same side. We then join together every two parts, by sewing round the free edges with wool or yarn. When the whole is finished, the joins must be on the inside.

In the same way a lamp - shade may be made. For patterns see Figs. 254 and 255.

We have now given examples in abundance of cardboard-work without by any means exhausting the subject. See for a more exhaustive treatment of the subject, *Cardboard Modelling*, by W. Heaton (Newmann & Co., London, 1894). It will be found that girls, no less than boys, delight in such exercises, where skill of hand and ingenuity in arranging and combining are alike required. In decorating the baskets with ribbons and mounted pictures we need hardly say that the girls excel.

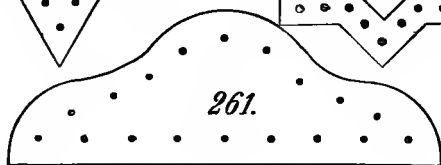
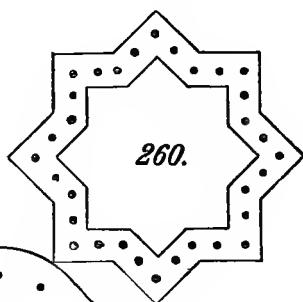
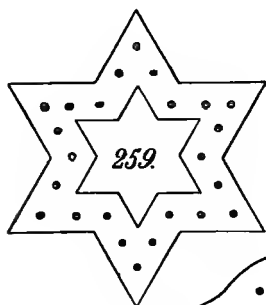
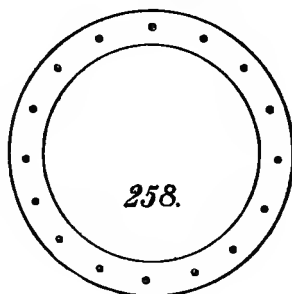
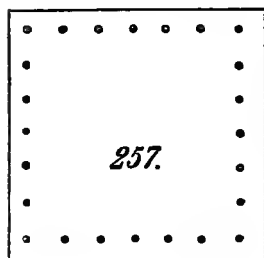
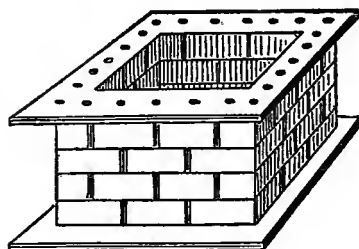
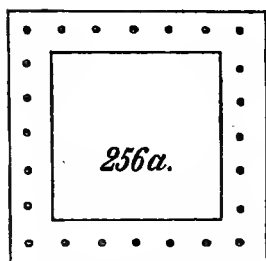
6. WORKING WITH THIN "WOOD-PULP."

By way of practice in the cutting of thin "wood-pulp," the children may construct simple geometrical figures, such as squares, triangles, hexagons, circles, six-pointed and other stars. Beginning with "wood-pulp" 1 mm. thick, they may afterwards proceed to leather and press boards.

From geometrical figures they advance to the making of boxes, sticks for stick-laying, and strips for the weaving mat.

An open box with a square bottom is constructed as follows. First we cut two square pieces of wood-pulp, with $4\frac{1}{2}$ -inch sides. One of these pieces forms the bottom of the box (Fig. 257). The other is used to form the upper rim.

About $\frac{1}{2}$ in. from the edges we draw lines parallel to them, and cut out the inner square (Fig. 256 a). On the rim thus formed we mark points equidistant from each other, the interval between any two being $\frac{3}{8}$ in. to $\frac{9}{16}$ in. We next lay the upper rim on the bottom of the box, and pierce with the marking-point each one of the points on the rim. The tool must also penetrate the bottom. The holes made by the marking-point are then enlarged by means of a punch, so that little sticks, such as those used in stick-laying, can be inserted. These sticks are first made fast in the bottom, then the rim is laid upon them, and they are pressed into the holes in the rim. The next step is to weave through the sticks cardboard strips, from $\frac{3}{16}$ in. to



$\frac{3}{8}$ in. wide. The general appearance of the basket is improved if we choose strips of various colours. The ends are secured with glue. The boxes suggested by Figs. 258–261 are made in a similar manner.

It is necessary that boys at the present stage should also learn to perform the following task:—

Binding and cutting a small exercise-book. From two to five sheets of foolscap or note-paper are folded and laid one within the other. The oftener we fold a sheet the greater is the number of leaves, the smaller the size of the book. Thus, if each leaf is a half-sheet, the size is called folio; if the sheet is divided into four, quarto; and so octavo, and duodecimo. The last fold marks the back of the book. When we have folded once a sheet of thick blue paper, cut to a suitable size, and laid the inside sheets with the crease upwards, the binding or covering begins. We commonly use strong grey thread. Holding firmly with the left hand cover and sheets face downwards, we pass the needle in the middle from inside to outside; then $1\frac{1}{2}$ in. from the upper edge, from outside to inside. We next bring the needle to $1\frac{1}{2}$ in. from the lower edge of the crease, and prick from inside to outside, then in the middle through the hole first made, from outside to inside. The thread along the inside of the book is secured between the two free ends of the thread, the latter being drawn tight, twice knotted, then cut off. Next comes the cutting of the book. First we mark with the square and a pencil the lines at the top, bottom, and side, along which we propose to cut. A sharp knife is drawn over each of these in turn often enough to cut through all the leaves. The knife must be kept straight, and the iron ruler by which it is guided must be firmly held, if the cutting is to be true. Lastly, on the front cover of the book a little label may be pasted. Patterns for such labels will be found in Figs. 193–198.

7. WOOD-WORK WITH USE OF THE KNIFE.

Whilst the exercises hitherto given have been, at least in part, admitted into various Courses for the Kindergarten and Magazines for the Young, in introducing wood-work for boys of from nine to ten or eleven years of age, it may be possible to offer something new. The course now suggested is an extension of that already sketched out in our earlier book.

The tasks under this heading can be executed with an ordinary pocket-knife or kitchen-knife. The blade must not be too stiff or too weak. Thus the knives sold for paper-cutting are unsuitable. Kitchen-knives, costing about threepence each, are in Germany considered sufficient; most English teachers will prefer to entrust their boys at once with the Nääs knife, employed in Wood-Sloyd. The blade is 4 in. long by $\frac{3}{4}$ in. broad; it does not taper to a point, but the end makes an angle of about 75° with the cutting edge. The cost of the knife is only about ninepence; so that though any *good* pocket-knife will serve our purpose, a knife of the Nääs pattern is to be recommended as cheaper as well as more serviceable. The pointed Sloyd knife has also certain things in its favour.

The objections which have been raised to use of the knife at the age we are now considering are not substantial. It is better that boys should learn to apply the knife to the making of useful things, than that they should employ it in secret to damage and destroy. A boy of ten is not content to exercise his strength on paper or wood-pulp: he seeks some stronger material. He is delighted to bring his knife into play, for instance, in the garden, where he borders his flower-beds with twigs or splints. Nor should we repress his inclination to cut and fashion, but rather direct it into right paths: it is only one of many manifestations of the impulse to activity. We must teach him that the knife is a tool, not a mere toy; teach him how to sharpen it on a stone, and how to handle it without injury to himself. If

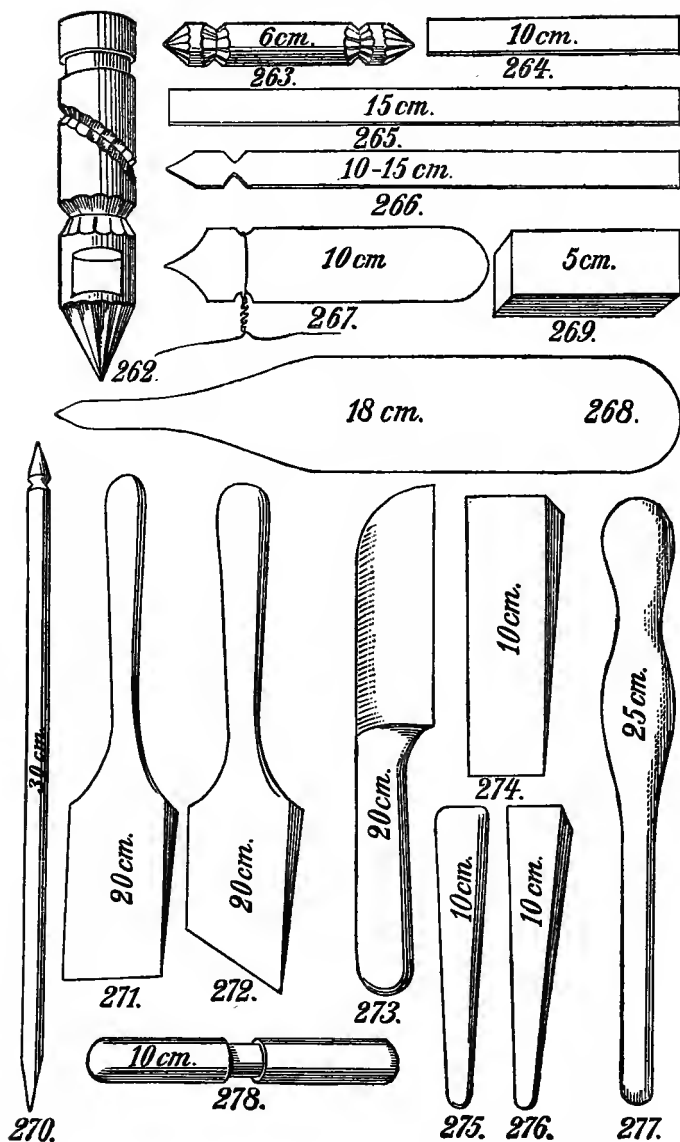
he cannot sharpen a pencil, make a peg, or cut a stick from a tree properly, he is the laughing-stock of his playmates, and is justly reckoned awkward or helpless. On the other hand, dexterity in the use of the knife is an accomplishment of lifelong value.

The exercises which follow are intended to instruct him how to make things of use and beauty with the knife as his sole or principal tool.

The raw material requisite for the work is easily procured. Suitable pieces, which can readily be split, are often to be picked out from common firewood. In winter every garden in which trees or shrubs are trimmed yields a supply of branches and twigs which can be made available for our purpose. Every kind of wood is serviceable. If we have the choice, we prefer for these introductory tasks soft wood, but hard may also be used.¹ By hard timber we mean that which offers great resistance to the tool. Such timbers are hornbeam, maple, apple, pear, oak, and beech, whilst ash, elm, walnut, and chestnut are less hard. Scotch fir, spruce fir, larch, and poplar are reckoned soft timbers. Ash, beech, alder, oak, Scotch fir, and spruce fir are easily split, and are therefore very suitable for much of our present work. For schools and institutes we recommend especially outside pieces of spruce fir, free from knots. These can be obtained from any dealer at a moderate price. From them we cut lengths of 50 cm., 20 cm., and 10 cm., and split with the axe to the thickness of ordinary faggots. We shall then have all the material necessary for the work here given. For measuring we now use a metre folding-measure, costing about 1s. or 1s. 6d. The metre system is quickly mastered even by young children.

Fig. 262 is what we may call a pattern stick. It is round, 16 to 20 cm. long, and from 1 to 2 cm. in diameter. It may be of ash, willow, maple, birch, spruce fir, or other wood. The bark is left on the stick, so that the cuts show

¹ On timber, see Salomon's *Handbook of Sloyd*, pp. 27-58.



more clearly. On it we practise pointing, cutting in, cutting off, and rounding. The attention of the learner must be called to the different ways of holding and guiding the knife in the different processes.

Fig. 263 represents a small parcel-holder with pointed ends and decorative cuts. The wood may be taken from the garden. Such an implement may also be used for twisting a cord tight.

Figs. 264–266 show thin laths, split with the knife from spruce fir. Any number of them may be made for practice or for use. Made according to Fig. 266, they serve as uprights for the railing drawn in Fig. 295.

Fig. 267 represents a small plant-label, such as is used in gardens on trees, rose-bushes, and shrubs generally. It is intended to be hung on the plant; hence the wire attachment in the narrow part. Fig. 268 gives another form of plant-label, to be stuck in the bed near the flower.

Fig. 269 suggests the production of a quadrangular beam. The wood may be cut 5, 10, 15, or 20 cm. long, and from 1 to 1½ cm. broad and deep.

Fig. 270 brings us to the making of cylindrical objects. Such are: flower-sticks, paint-brush handles, sticks for fencing in garden beds or for the occupation known as stick-laying. The latter should also be made quadrangular, of the size of matches or larger.

Figs. 271 and 272 show two different forms of spatula, one with a straight, the other with an oblique edge. The spatula may be made larger or smaller according to the purpose it is intended to serve. Such implements have many uses both in the house and in the workshop. They are employed to lay on glue or apply putty, as well as for removing dirt, etc. If they are for kitchen use, they should be made of beech or maple, and be fairly broad.

The wooden knife drawn in Fig. 273 is made out of hard timber, and may be employed for opening letters or smoothing and cutting paper. It is also serviceable in moulding

with clay. The modelling tools shown in Figs. 146 and 147 should also be made at this stage, the best wood being pear or plum.

The wedge in Fig. 274 may be cut either from soft or from hard wood. If of the latter, it is of use in securing the handles of garden tools, axes, or hammers, or in fixing the legs of stools and benches. Before driving it in with a hammer, we round the upper corners off, so that it may not split.

The wooden pegs or plugs represented in Figs. 275 and 276, one round, the other quadrangular, serve a variety of purposes. Quadrangular pegs of the shape shown in Fig. 276, but somewhat thicker, are much used in conjunction with wedges, to insert hooks or nails in stone.

An equally useful object is the pin shown in Fig. 277. We find it on a chain as the fastening of a barn-door; or, decorated with chip-carving and hung on a cord, it will serve to secure the garden-gate. If straight, it may be used as one of the cross-pieces in a clothes-prop; or, curved as in the sketch, it makes a convenient planting-stick.

Fig. 278 shows another form of parcel-holder. The incision in the middle keeps the string of the parcel from slipping off. In Germany the peasants use an instrument of this shape for raising the harrow, to which it is attached by a rope. English children will know it as a handle for drawing toy carts. The length and thickness will be determined by the purpose to which it is to be applied.

Fig. 279 gives us a pointed beam, or, erected vertically, a pointed pillar.

Fig. 280 is another pattern stick (see Fig. 262). A number of these sticks should be made, and the various cuts which find application in the following exercises practised until some degree of dexterity is obtained.

To give the work a neat and finished look, it may be rubbed with sandpaper or glasspaper, but the proper use of sandpaper is to clean. In wood-carving, the strong, true cuts of the knife should not be obscured. But in this

elementary work round surfaces may be finished with sand-paper or powdered glass. The rasp may be introduced in some of the exercises, as, for instance, in making the paper-knife (Fig. 273) or the wooden pin (Fig. 277). For Fig. 273 may be substituted either the bookbinder's folding-stick, which is about 25 cm. long and has no handle, or one of the ordinary forms of the paper-knife as used in England.

8. WOOD-WORK WITH USE OF KNIFE, HAMMER, BRAD-AWL, ETC.

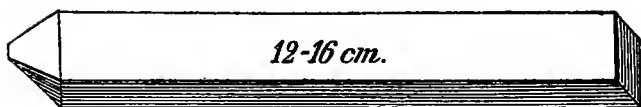
The hammer is now added to the number of tools we employ, and we begin to use brads and small wire-nails. Tacks are unsuitable for joining wood, but indispensable for attaching cloth, etc., to it.

The first application of the cuts practised on the pattern stick is shown in Fig. 281, the joint being formed by dovetail-halving. Other forms of halving are also introduced (Fig. 282). Various cuts shown on the pattern stick may be added as decorations or as distinctive marks.

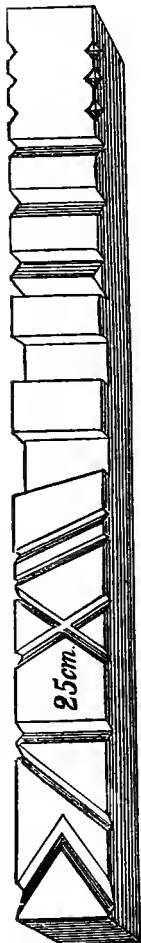
The objects represented in Figs. 283-285 are made from sticks cut in the garden and having the bark left on. The cross (Fig. 283) is used for mounting windmills (see Fig. 216 b). The cross in Fig. 284 makes a stand for flower-pots in a greenhouse.

Figs. 286 and 287 show two designs for borders of garden beds. Willow twigs will be the best material for reproducing Fig. 287.

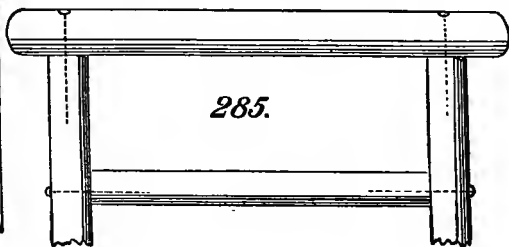
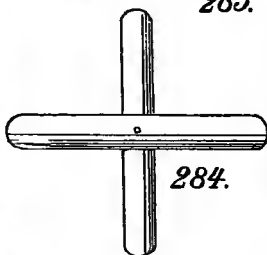
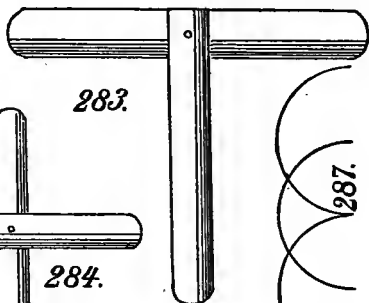
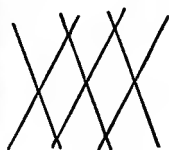
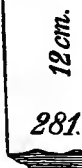
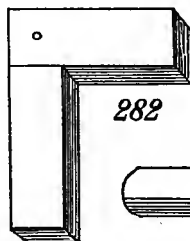
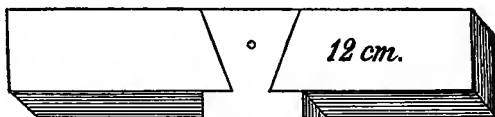
The triangle in Fig. 288, made on a large scale, would serve to support a carriage-pole in the coach-house. Two such triangles united by strong pieces of wood at the points where the arms cross would give us the saw-horse. The application of the object drawn in Fig. 289 will be no mystery to a boy accustomed to play with a toy cart or carriage. Well for him if he can himself repair the damage his vehicle may sustain.



279.



280.



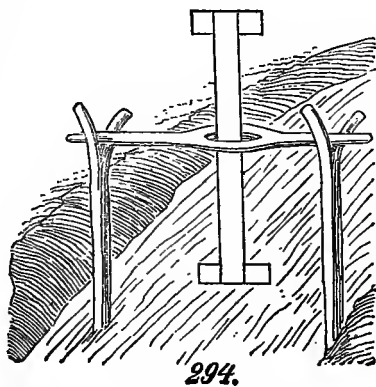
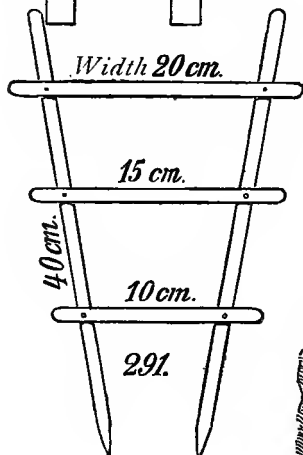
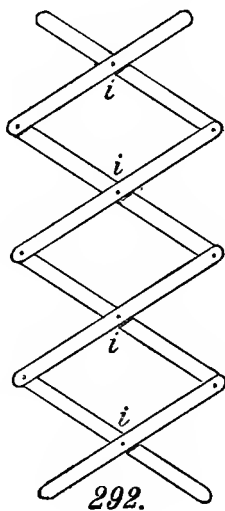
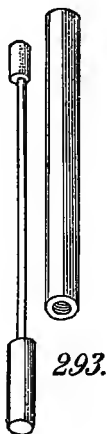
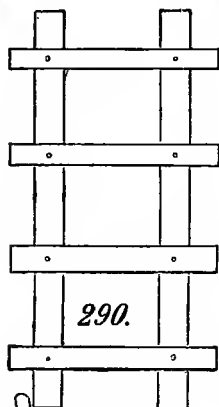
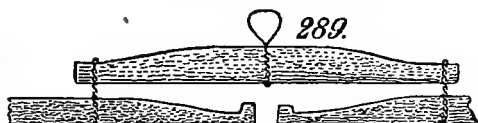
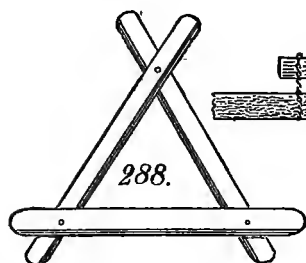
Figs. 290 and 291 represent ladders. The second may be made with either two or three cross-pieces, and is used as a climbing-stick in training plants.

Fig. 292 is the pretty toy known as the shears or scissors. If instead of tacks we take small screws, and place on them lead soldiers, we can make the latter march backwards and forwards at will. If we wish for a hastily-retreating army, we make the turning-points *i* not in the middle of the sticks, but towards one side, say 1 cm. to the left, and our soldiers will quickly execute the "right about face."

Fig. 293 shows us a **pop-gun**, the barrel being made of elder with the pith removed. Choose a branch two or three years old, and cut off pieces 20 to 25 cm. long. The pith can be thrust out with a stick. The rod is cut from spruce fir; the head formed with wadding and twine, so as to fit into the barrel without letting the air escape. When the gun is in use the head should be kept moist. If in the mouth of the barrel we fix a plug of potato or turnip, and push the rod quickly into the other end, the air in the barrel is compressed, and the plug flies out with a loud report.

From the pith of the elder, balls such as we see dancing on the tip of a water-jet in filter shops may be made, as well as the toy called the cork tumbler. To construct the latter we cut a piece of pith 4 cm. long, insert in one end a shoe-nail with a round head, and mount on the pith a red-painted man. If the shoe-nail is placed uppermost, the figure will tumble over and stand on the head of the nail.

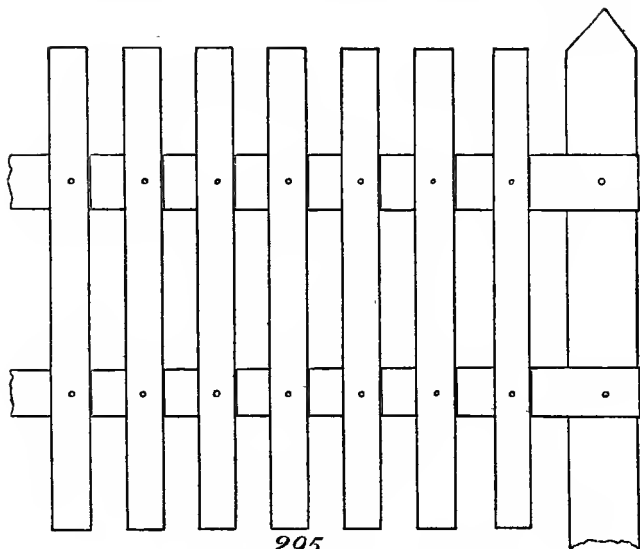
The **water-wheel** (Fig. 294) is an amusing toy for children by a brookside. It is made of alder or hazel wood. For the axle-tree we use a piece of the wood 20 cm. long and about the thickness of the thumb. In the middle we make two slits crossing each other at right angles, and thrust what we may call the spokes through these slits. Only one slit and one spoke are shown in the drawing. To the ends of the spokes floats are attached by means of nails, or by fixing them in slits made for the purpose. The axle-tree or shaft



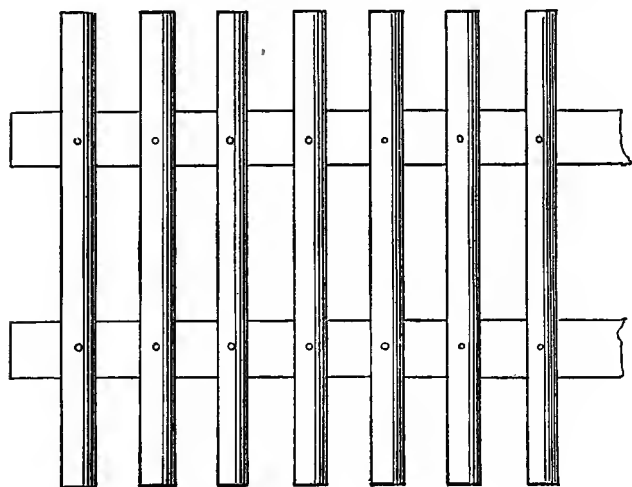
rests on two supports forked at the upper end. The extremities of the axle-tree may be formed of round nails driven into it; in which case it turns more easily in the supports. The floats must, of course, dip into the water.

Fig. 295 represents a **railing made of laths**. First two stronger laths, 21 cm. long, 2 cm. wide, and 4 to 5 mm. thick, are cut and carefully dressed. These serve as the cross-pieces. We then prepare ten laths, 10 cm. long, 1 cm. wide, and 2 to 3 mm. thick. These are the uprights. Laying the cross-pieces parallel to each other and with an interval of 3 cm. between them, we nail on the first upright to the left so as to project $1\frac{1}{2}$ cm. above the upper cross-piece, and the same distance below the lower cross-piece, and so as to leave 1 cm. at the ends of the two cross-pieces free. Proceeding in the same way with the upright to the extreme right, we have accounted for 4 cm. of the 21 cm. of each cross-piece. The intervening 17 cm. is occupied by eight uprights, each 1 cm. wide, and nine intervals of 1 cm. Thus the position of the remaining uprights will be fixed by marking off the centimetres on the two cross-pieces, and leaving 1 cm. division between each pair of uprights. To secure the equal projection of the uprights above and below the cross-pieces, lay a ruler from the top of the right-hand upright to the top of the left, and take this as your guide. Carpenters employ a string. The brads used are 1 cm. long. The thickness of upright and cross-piece together is from 6 to 8 mm. The projecting ends of the tacks must be bent down or filed off. In Fig. 295, as drawn, the ends of the cross-pieces are let into little posts. If it is used as a pattern, the right elevation of the uprights may be obtained by the use of the string.

Garden-fence with perpendicular palings (Fig. 296). The cross-pieces are of spruce fir, smoothly cut, 20 to 25 cm. long, $1\frac{1}{2}$ cm. broad, 5 mm. thick. The upright palings are of willow or hazel twigs, 10 cm. long. The construction is as described under Fig. 295.



295.



296.

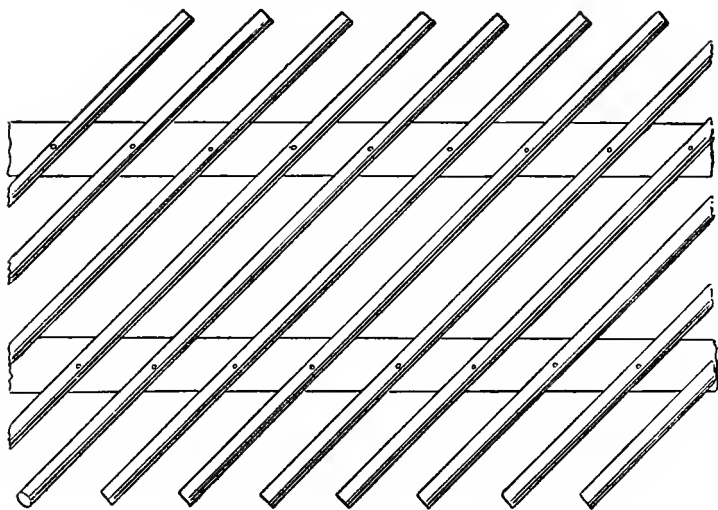
Garden-fence with slanting palings (Fig. 297). The cross-pieces are made 25 cm. long and 2 cm. broad. On the upper cross-piece perpendiculars are drawn 2 cm. apart, so that small squares are formed. The diagonals of these squares give the direction and distances of the palings, which are nailed on as shown in the figure, the diagonals used being those from the left-hand bottom to the right-hand top corners.

The more expert boys may nail on another set of palings in the direction of the diagonals from the left-hand top to the right-hand bottom corner, so as to produce a sort of lattice-work. Another way of producing regular intervals between the palings is to lay a lath of the proper width between them and to use it as a guide. In this case, too, the cross-pieces may be let into little posts, as in Fig. 295.

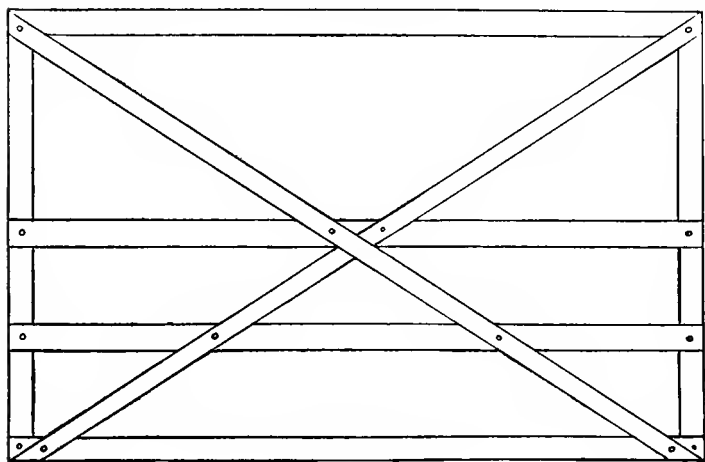
The hurdle (Fig. 298). We first cut two laths, 20 cm. long, $1\frac{1}{2}$ cm. broad, and 5 mm. thick, then four others of the same breadth and thickness, but 30 cm. long. The four longer cross-pieces are nailed on to the two shorter uprights, as shown in the drawing. To hold the framework firmly together, two other strips are nailed across diagonally. The projecting ends are cut off, after the two strips have been nailed on.

The wattled fence (Fig. 299). To make this fence we take willow twigs, peeled or unpeeled. The uprights are made of strong withies about the thickness of a lead-pencil and 10 cm. long. They are left round, that the wattling may be easily effected. These uprights are fixed in holes bored in a strip of wood. We next split a number of twigs 20 cm. long, and weave them in so through the uprights that the smooth or split surface is, at the first upright, on the inside. When the weaving is finished, half-round twigs are nailed on to the ends of the uprights, and the fence obtains the necessary firmness.

Such wattled fences were made in the earliest times, and



297.



298.

used in the construction of dwellings and enclosures, the protection of river-banks, etc. They are still to be met with in many neighbourhoods.

The ornamentation of a surface with half-round sticks (Figs. 300–303). This work is somewhat laborious, and must be executed with the greatest care. It will be well to have small boards of Scotch fir (*pinus silvestris*) made, 30 cm. long, 18 cm. broad, and $1\frac{1}{2}$ cm. thick.

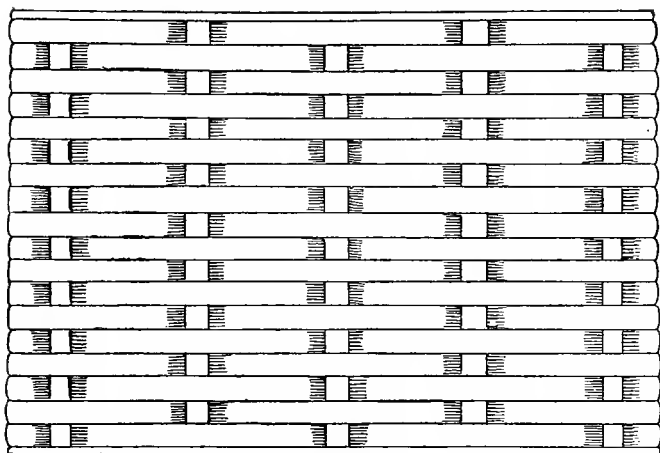
On these boards, which need only be dressed with the smoothing-plane, we first lay the half-round sticks which are longest. In Figs. 301 and 302 the longest will be those which cross the boards diagonally; in Fig. 300, the upper and lower sides of the parallelograms; in Fig. 302, those which form the angular points of the largest squares. The most advantageous course is to set out the whole pattern on the board, and then to work according to it.

Besides the four patterns given in the sketches, many others may easily be devised. Further variety may be introduced by employing twigs with brown, grey, or green bark. Strips of cane and artificially coloured sticks are also serviceable.

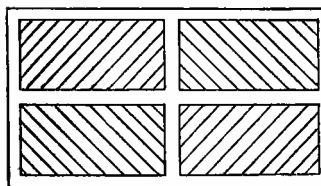
In nailing the sticks to the surface the nails must not be driven in too near the ends; otherwise the sticks will split. The brads or tacks used must be as thin as possible. When the nailing on is finished, the sticks may be coated with varnish.

In Figs. 304–307 we give four articles for home use, to be made from the cuttings of garden trees.

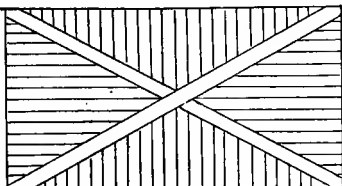
Fig. 304. Miniature crate. The bottom consists of a thin board, 10 to 12 cm. square, 1 cm. thick; the oblong shape is also suitable. Split withies are used for the sides, two being nailed at each corner contiguous to each other so as to form the legs. The rest of the procedure is shown by the figure. The uprights and cross-pieces may alike be left round. Lined with stuff or paper, the crate serves as a girl's work-basket or as a cigar-holder.



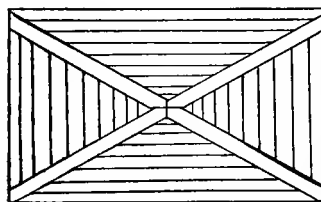
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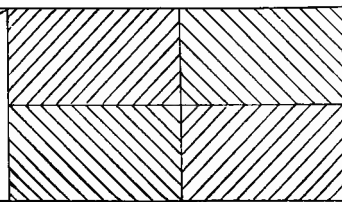
300.



301.



302,



303.

Fig. 305. **Small stand for photographs.** This may be made of hazel or maple twigs. Bronzed, gilded, or enamelled, it forms an elegant ornament for a drawing-room table. The design is, of course, borrowed from the easel.

Fig. 306. **Rest for pen-holders.** The sketch shows only one of two similar ends, which are to be joined by cross-pieces.

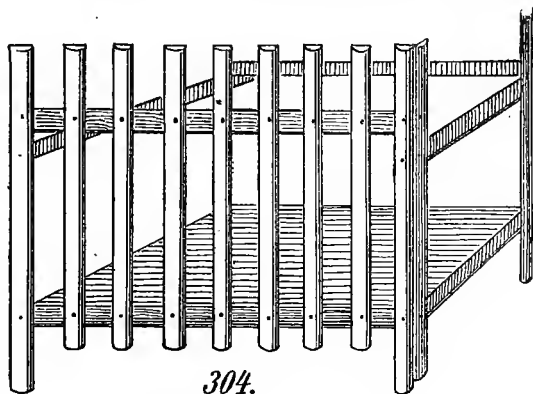
Fig. 307. **Key-board.** This is a familiar contrivance for hanging up loose keys in a kitchen. The method of construction is clear from the figure, and needs no description.

9. ELEMENTARY EXERCISES IN THE USE OF THE FRET-SAW.

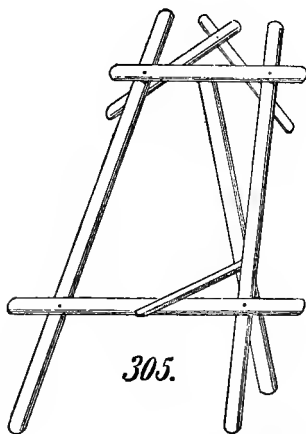
[Before introducing his pupils to these exercises, the teacher may wish to give a brief account of the nature of saws in general, and an explanation of such simple terms as *teeth*, *kerf*, *set*, etc. See Goss, *Bench Work in Wood*, §§ 49-57, Ginn & Co., Boston, 1888.]

Strong objections have been raised to the use of the fret-saw, especially by the opponents of all manual work for boys. We are, however, compelled to recognise its value as a tool at once simple and useful. Not only is it most convenient for dividing weak wood, but it is easily handled, and applicable to the production of a long series of forms. These forms may be bounded either by straight lines or curves, the surfaces may be either unbroken or pierced. For the present we are only concerned with work in which the surfaces are unbroken, in which, therefore, the outlines only are to be traced by the fret-saw; it will not be necessary to release the blade and attach it again, as is the case when holes are bored.

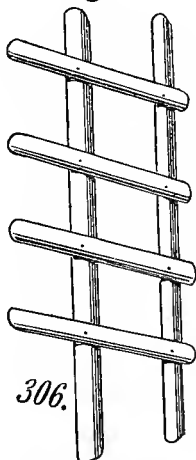
The distinctive feature of the fret-saw is the rectangular frame (*a*, Fig. 308), which may be of wood, iron, or steel. A wooden frame is lighter and more durable, but dearer than a



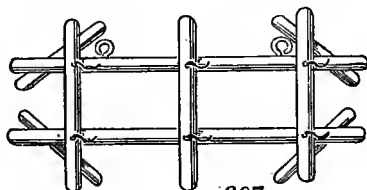
304.



305.



306.



307.

metal frame. The width, that is, the distance along the side-arms from *b* to *a*, is various. For our work at this stage a width of 25 to 30 cm. will be found sufficient, and frames of this size cost from 1s. 6d. to 3s. according to the quality and make. Fitted with a patent spring, the price is about 5s.

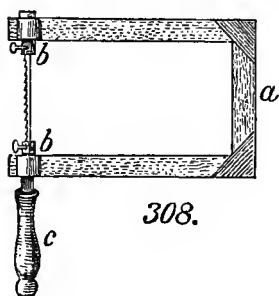
The complete tool consists of the following parts:—

1. The frame.
2. The two clamps (*b b*). Each clamp has two faces set with teeth. These faces can be pressed tightly together by means of a screw, so that the blade of the saw can be firmly secured between them. One clamp is fitted into the handle (*c*); both are generally adjustable by means of screws.

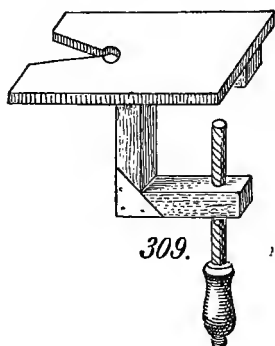
3. The blade. This is a narrow strip of steel with saw-teeth (Fig. 311), which all point in the same direction. When the blade is fastened in the clamps, it is so placed that the teeth are on the outside, and pointing downwards towards the handle (Fig. 308). In buying blades, choose for the exercises which follow Nos. 1 and 2, and see that the teeth are sharp and that the blades show no signs of rust. To fasten the saw-blade in, we bring the ends of the side-arms somewhat closer together, by pressing the frame against the table, and then screw the blade in so tightly that when struck it gives a musical note.

In using the fret-saw we need some form of cutting-board. Fig. 309 shows such a board, made of beechwood, and fastened on to a hand-screw, by means of which it can be attached to a table.

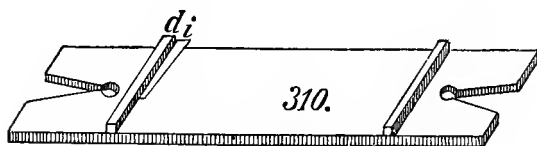
The cutting-board shown in Fig. 310 is also highly to be recommended. The strip *d* on the under-side being fixed not quite perpendicularly, a wedge *i* can be driven in between the edge of the table and the strip. A board of this kind may be 18 to 20 cm. wide; its length will depend on the size of the table to which it is to be secured. Two boys can work at it simultaneously.



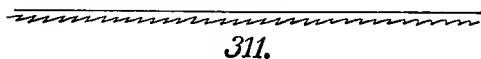
308.



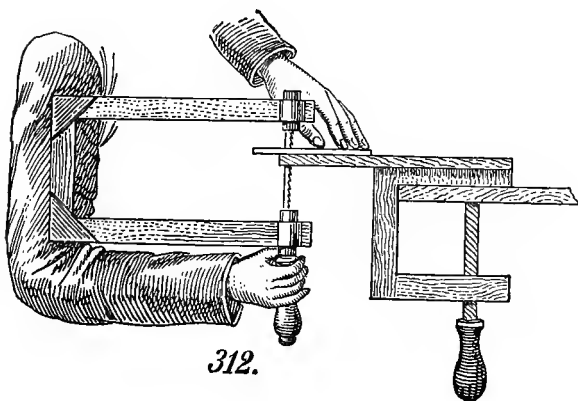
309.



310.



311.



312.

In regard to the wood used, it may be alder, poplar, birch, beech, or maple. The pieces need not be above 5 mm. thick. By maple we mean the wood of the great maple (*acer platanoides*), known in commerce as sycamore. It is white, close-grained, and does not easily split or warp. This is perhaps the most suitable wood for fretwork. Cigar-boxes, made of South American cedar, also yield serviceable material. See Professor H. Cranz, *Vorlagen für Arbeiten aus Cigarrenkastenholz*, Schreiber, Esslingen.

The outline to be sawn is traced on the board by means of cardboard or zinc patterns. The latter must be prepared by the teacher or by older boys; the former can be made by every child who has learned paper-cutting and gained some little experience in drawing. Both drawing and cutting-out must be executed with the greatest accuracy. Used post-cards or old playing-cards serve well enough for making the patterns.

The pattern finished, a well-pointed lead-pencil enables us to transfer the shape to the wood. We then test its exactness with ruler, measure, square, and compasses, and make any corrections which may be found necessary. Comparison should be made not with the cut pattern, but with the original from which it was taken.

Now begins the process of sawing. With the left hand the wood is pressed firmly on the cutting-board and guided along the lines of the pattern to the saw. The right hand, in which the saw is held, does not change its direction, and must be moved up and down in such a way that the blade is always exactly vertical. The saw is worked with gentle pressure; the wrist must not be too stiff. See Fig. 312.

It may be convenient if we append a list of the prices commonly charged for the tools and wood used in fret-saw work:—

Tools.

Fret-saw frame	
(1) of wood	2s. to 5s.
(2) of steel	1s. to 3s. 6d.
Cutting-board (pattern as in Fig. 309)	
(1) With one handscrew	1s. to 2s.
(2) With two handscrews	1s. 6d. to 3s.
Cutting-board (Scotch fir, pattern as in Fig. 310)	
Fret-saw blades Nos. 1 and 2 per doz. .	2d. to 6d.
File (with handles)	6d.

Wood.

(It is important that the wood should be well seasoned. Dealers will supply it carefully planed.)

	$\frac{1}{8}$ in.	$\frac{1}{4}$ in.	$\frac{3}{8}$ in.	$\frac{1}{2}$ in. thick.
Walnut	4d.	6d.	10d.	1s. per square foot.
Cedar	6d.	8d.	1s.	1s. 3d. ,,
Pear	6d.	8d.	1s.	1s. 3d. ,,
Mahogany	4d.	6d.	10d.	1s. 3d. ,,
Birch	4d.	4d.	6d.	8d. ,,
Sycamore	4d.	4d.	6d.	8d. ,,
Oak	6d.	6d.	8d.	10d. ,,

WORK WITH THE FRET-SAW.

The designs shown in Figs. 313-320 may be reproduced on the same scale as the drawings; perhaps, however, in the case of Figs. 315 and 316 enlargement may be advisable.

Sawing in straight lines is practised on :—

The square (Fig. 313). When the form of the square has been outlined, we begin to saw at *a* in the direction towards *b*. To obtain a sharp corner at *b*, we guide the saw a little outwards in the piece that is to fall off, so as to make a wide kerf in which the blade may be turned. We then continue the sawing from right to left.

By way of practice six such squares should be cut out. If the edges prove to be not quite smooth, as is usually the case at the outset, they are rubbed with a piece of sand-

paper or glasspaper. That the glasspaper may not crumple up, it should be glued to a piece of board.

Another useful exercise is to cut a fairly large square (8 to 10 cm. side), and then to divide it into right-angled triangles by sawing along the diagonals.

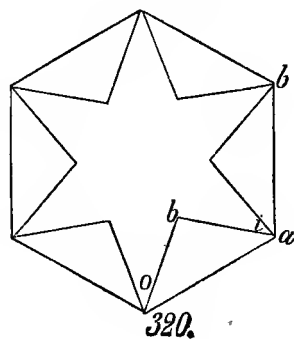
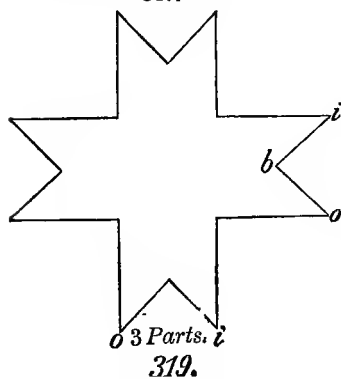
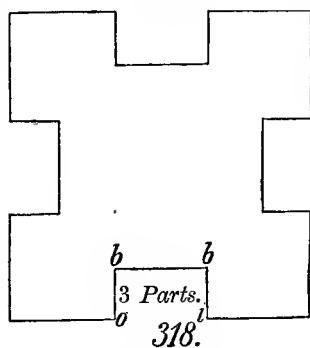
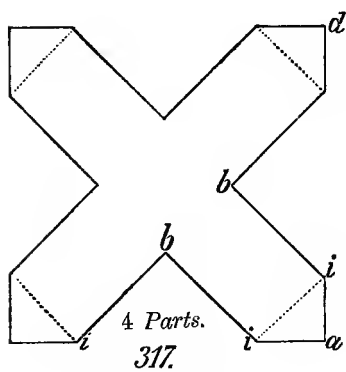
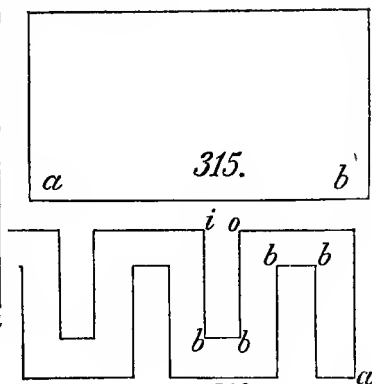
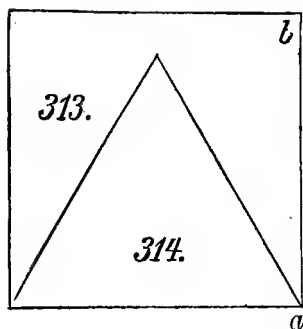
The equilateral triangle (Fig. 314). The triangle is drawn inside the square. The process is as described under Fig. 313. Four of these triangles should be sawn.

The oblong (Fig. 315). Make three oblongs. Divide one by sawing along a diagonal. From the corners of the second cut off equal and similar triangles. Use the third to obtain the pattern shown in Fig. 316.

The regular hexagon (Fig. 320). To draw the hexagon, describe a circle, then use the same radius to obtain the six points. Join these in order by straight lines. The sawing begins at *a*, proceeds in the direction of *b*, and so on. This exercise should be repeated six or eight times, and the edges and surfaces of the hexagons carefully cleaned with sandpaper.

The sawing out of stars (thread-winders, etc.). A simple form of star, known to most boys, is produced by joining every other point of a regular hexagon. Other shapes are given in Figs. 317, 318, 319, and 320. The drawing of the designs is easy, especially if the indications given by the plates as to the division of the sides of the fundamental form are followed. Moreover, many boys will have become familiar with such star-shapes in the drawing-lesson, and will have no difficulty in reproducing them.

Two forms of Fig. 317 are possible, and both should be cut. The second is suggested by the dotted lines. Here again the sawing begins at *a* and proceeds to *i* and *b*. At *b* work the saw a little in the piece that is to fall off, so as to be able to turn sharply round towards *d*. Remember the general rule of sawing: the kerf is always in the waste piece.



In Fig. 319 the order of sawing is as follows: first, the fundamental square is cut; then the triangles at its corners; lastly, the small triangles (*o b i*). In the case of such triangles we always saw from without to within. For example: after sawing from *o* to *b*, we withdraw the tool and saw from *i* to *b*. By this means we secure sharp angles without turning the saw in the kerf.

The procedure is the same in Fig. 320 *b*, the star drawn in Fig. 320. The cut surfaces are smoothed with a file, the whole work is finished with sandpaper and varnished.

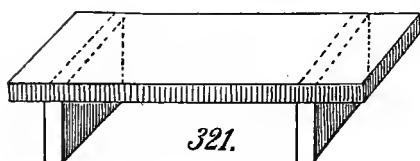
The joining of sawn boards. The bench. Fig. 321 represents a toy bench for a doll's house. To make it, we take wood 3 mm. thick. The seat may be 5 cm. long, 2 cm. broad; the legs, $1\frac{1}{2}$ cm. high. Great care must be taken in nailing the seat to the legs. Three tacks, or better, small brads, are used for each leg.

The box (Fig. 323). The dimensions of the front and the back are 7 cm. by $2\frac{1}{2}$ cm.; of the ends, 2 cm. by $2\frac{1}{2}$ cm. The bottom is cut of the same length as the front (7 cm.), but broader than the ends by twice the thickness of the wood employed.

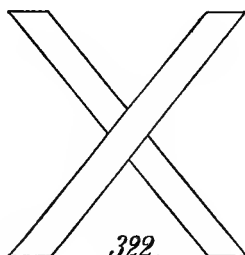
Table supported on trestles (Fig. 322). One of the latter is shown in Fig. 322. It must be made in duplicate. If thin strips be glued on to the under-side of the table-top so that the upper ends of the trestles just fit between them, the table will stand, and will serve to adorn a girl's miniature kitchen.

Tesselated pavements, etc. Figs. 324 and 325 exhibit two decorative patterns, the construction of which is rendered clear by the plates. Wood of different colours is used, and the strips, when sawn, are glued on to a thicker piece of wood. In such work we may utilise the waste from other exercises. The patterns may be multiplied at will, and parquetry floors, tesselated pavements, etc., may be represented.

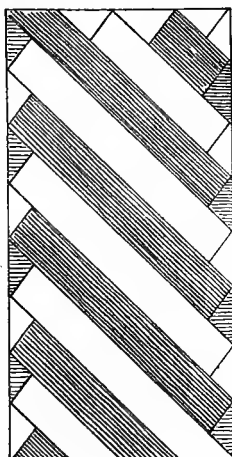
The sawing of curves now begins.



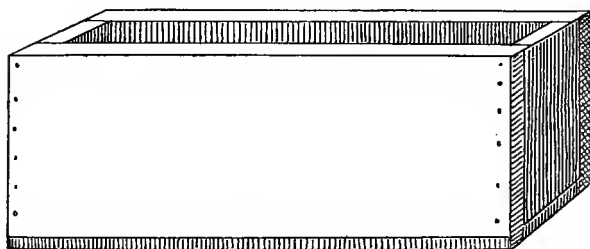
321.



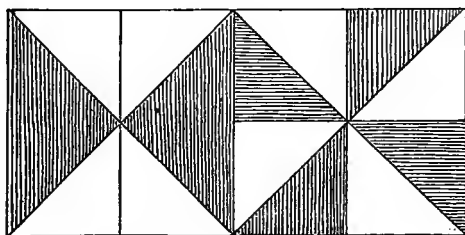
322.



324.



323.



325.

Silk-winders, etc. Figs. 326, 327, and 328 show three patterns for silk-winders, which are to be made of the same size as they are in the plates. The drawing is easy, if the patterns are carefully examined. In sawing we first cut out the squares, and then deal with the curves. In the case of Fig. 328 it will be advisable to begin each saw-cut from without, so that the corners may be true. The pieces which fall off are to be preserved. They serve as laying-tablets for younger children. Or they may be painted red, blue, and black, and arranged to form ornamental designs, as in Fig. 325.

The sawing of circles and segments of circles requires extreme care and minute attention.

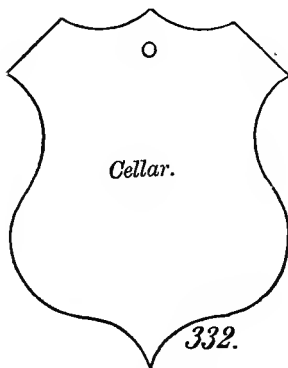
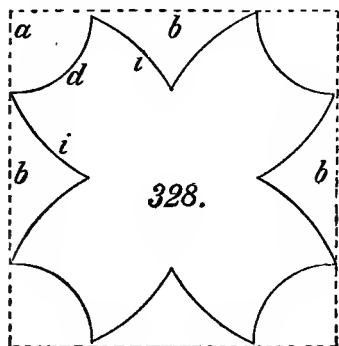
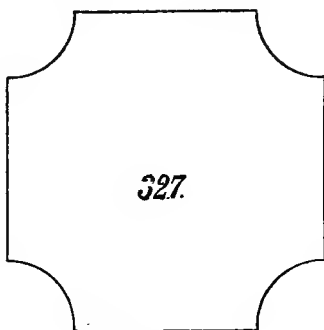
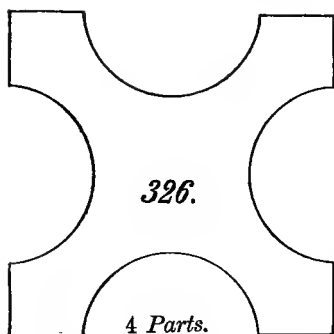
Circles should be cut of various sizes, and the exercise of cutting them should be repeated many times. The wood patterns employed in modelling with clay may be made, as well as stands for ink-pots and many other useful articles. Using wood 5 mm. thick, we may cut a circular form, paint on it concentric rings, and so provide ourselves with a small target for dart-shooting.

The exercises numbered 329–332 are intended to confirm the learner in the power of cutting curves neatly and accurately. Examples may be multiplied by the teacher. We suggest also : pallet (without thumb-hole), pear-shaped tablets, trefoil, and ornamental door-plates.

In Figs. 330 and 331 two patterns are given for making railings, the tops showing curved outlines. Fig. 329, to be reproduced as regards breadth to the scale of the drawing, is a common form of plant-label. The length should be about 15 cm.

Key-labels. Fig. 332 shows one of many forms for key-labels. The pattern must be cut from a post-card ; the sawing requires the greatest care. The label is rubbed smooth, lettered, and varnished on both sides.

The bracket (Fig. 333 *a* and *b*). The top is semicircular in form ; its size depends on the purpose to which the



bracket is to be applied. Made to the scale of the drawing, it will serve to support some little article of bric-à-brac ; but by enlarging the dimensions we can obtain a flower-pot stand. When both parts have been sawn and rubbed smooth, on the upper and lower surfaces of the top lines are drawn at right angles to the straight edge from its middle point. These lines guide us in nailing or screwing the parts together. The wood used should be fairly thick, to give the impression of strength and for convenience in nailing.

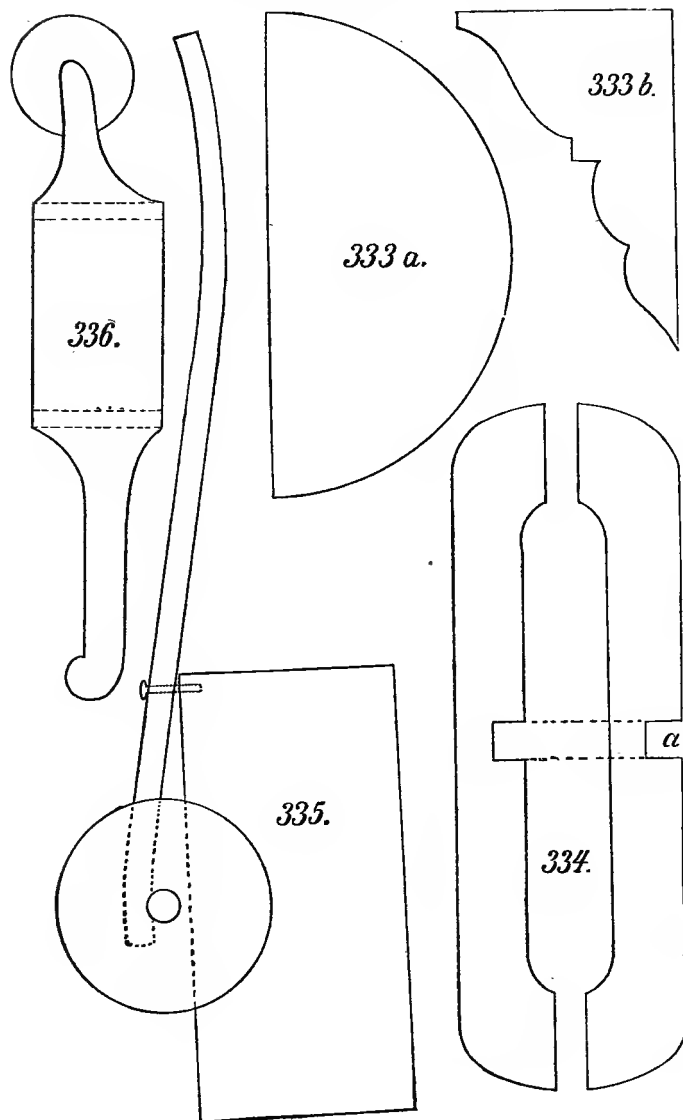
Flower-pot cross (Fig. 334). Choose hard wood from 8 to 10 mm. thick. The cross, of course, requires two pieces to be cut. In one the incision *a* is on the upper side, in the other on the lower. The method of joining here employed is technically called lap-halving. The cross should be coated with varnish. The same figure, made at the bench on a larger scale, is known in England as the pan-stand.

Two box-carts for children to play with (Figs. 335 and 336). Fig. 335 consists principally of a box such as was shown in Fig. 323. Across the bottom an axle is fastened, its ends passing through wheels. The pole is attached to the middle of the axle and also to the bottom of the box, as indicated in the plate.

Fig. 336 represents another pattern of box-cart. It can also be reproduced on a larger scale.

10. SUPPLEMENTARY OR REVISION EXERCISES IN CUTTING OUT.

Before proceeding to chip-carving, which naturally follows fret-saw work, we give some further exercises in cutting out paper, and also in moulding. The teacher may treat them as supplementary to the matter contained in II. 8, p. 48 ; III. 3, p. 60 ; and III. 2, p. 56 ; or they will enable him at once to vary the work of his pupils and to recall the dexterity before acquired.



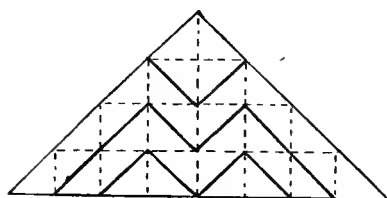
Figs. 337-344 contain some attractive designs for cutting out. Figs. 337-340 involve only straight lines, whilst in Figs. 341-344 the cutting is chiefly in curves. The eight open edges of the sheet, which has been folded as in Fig. 137, are to the left. If the sheet be only folded twice, so that it is in four layers instead of eight, it may still be cut according to Figs. 337-340, but in that case totally different forms will be produced.

In Figs. 345-347 the process of developing the hexagon from the square is exhibited. The square is first folded along a diagonal (Fig. 345); the points of the triangle thus obtained are so turned down that $n i a$ and $n i b$ (Fig. 346) are each an angle of 60° . If the child is not yet familiar with the measurement of angles, $i a n$ and $i b n$ are turned over so that three equal triangles lying one on the other are formed, that is to say, so that the fold is in $i n$. If we cut along $n n$ and unfold the sheet, our hexagon is complete (Fig. 347).

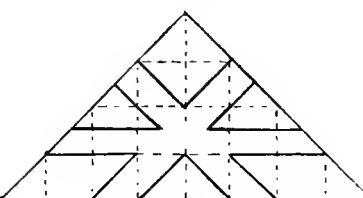
From the hexagon thus made, the folded triangles used in the following exercises (Fig. 348-356) are derived. Fig. 348 shows such a triangle and a method of cutting it, whilst Fig. 349 exhibits the pattern that results when the sheet is unfolded. The drawing is set out by means of the auxiliary lines indicated (Fig. 348).

The open sides of the folded sheet are in Figs. 351-356, as in Fig. 348, at the base of the triangle; in Figs. 357-363 their position is marked a . The series last mentioned is based on the square folding-sheet; all the patterns in it will furnish excellent drawing copies. As we have before said, the pieces that fall out during the cutting must be kept, not destroyed.

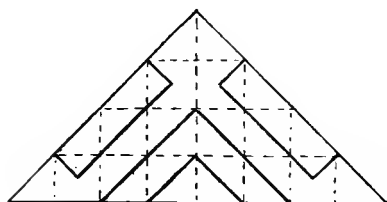
Figs. 364 and 365 are examples of humorous designs. Glazed or tissue paper may be used, fourfold, sixfold, or eightfold. The inventive boy will find no difficulty in devising similar figures for himself. All pupils, as they grow expert, should practise free cutting out, that is, cutting out without first drawing the lines to be followed.



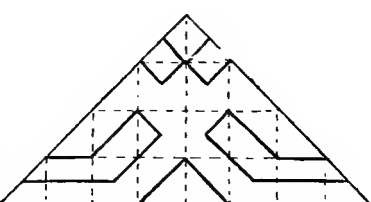
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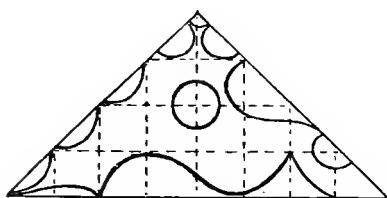
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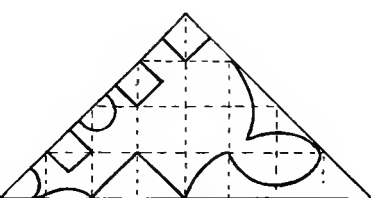
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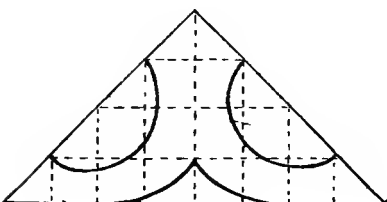
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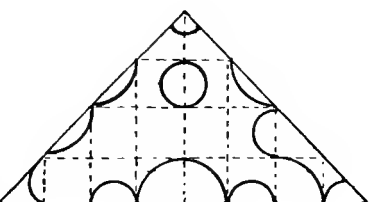
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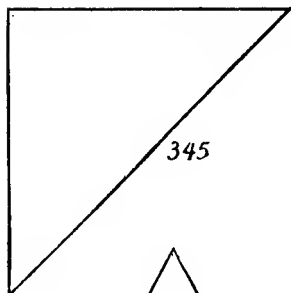
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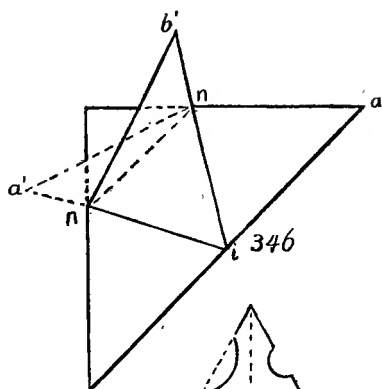
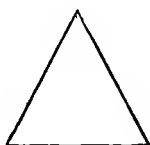
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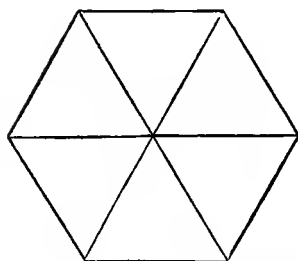
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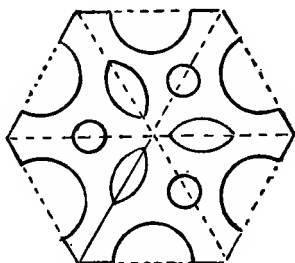
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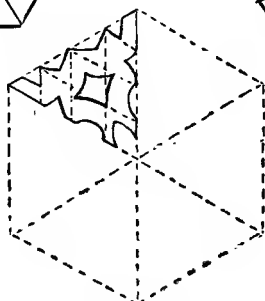
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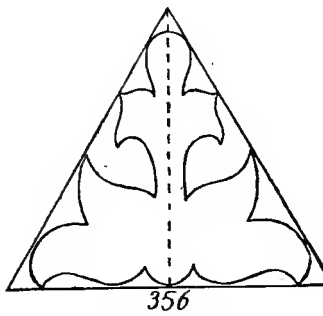
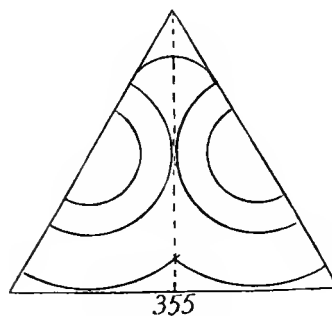
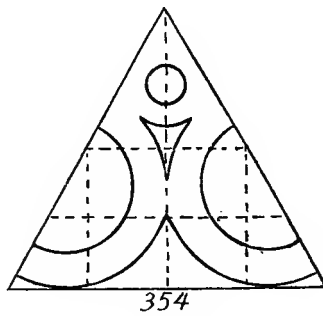
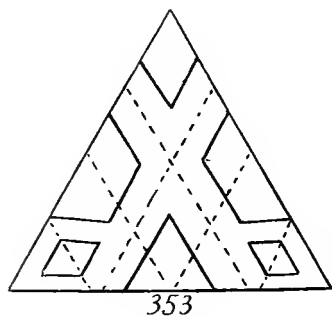
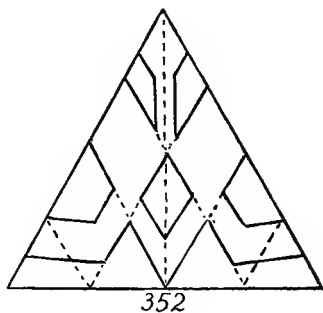
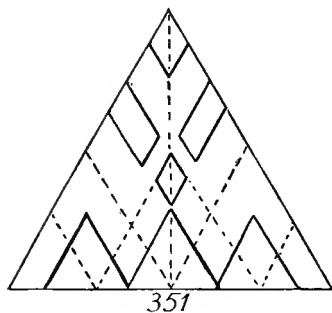
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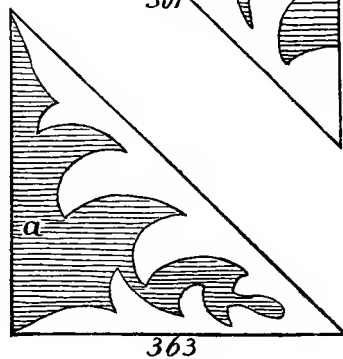
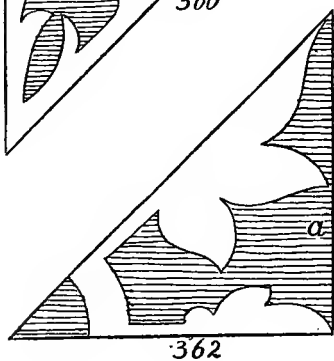
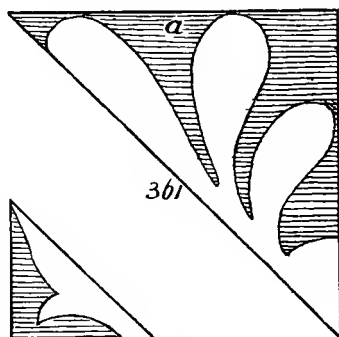
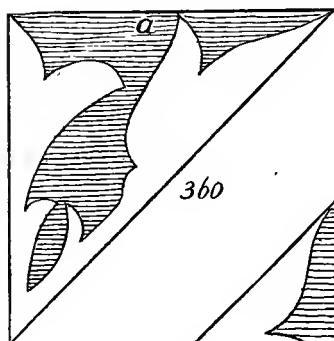
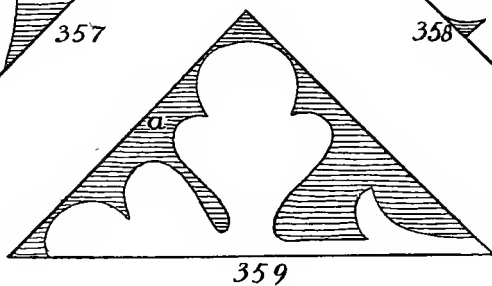
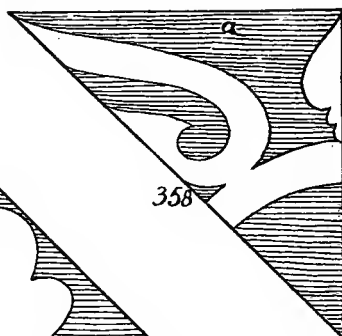
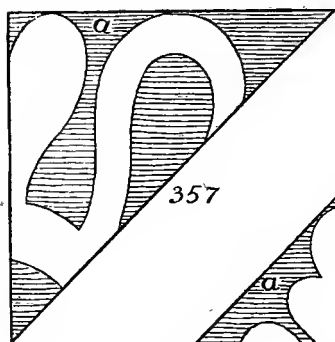


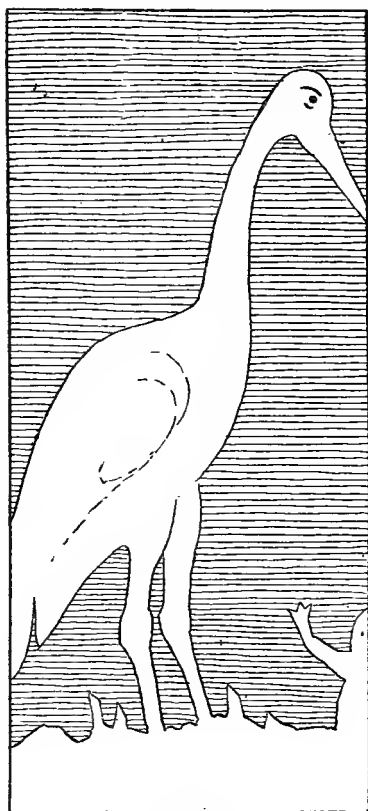
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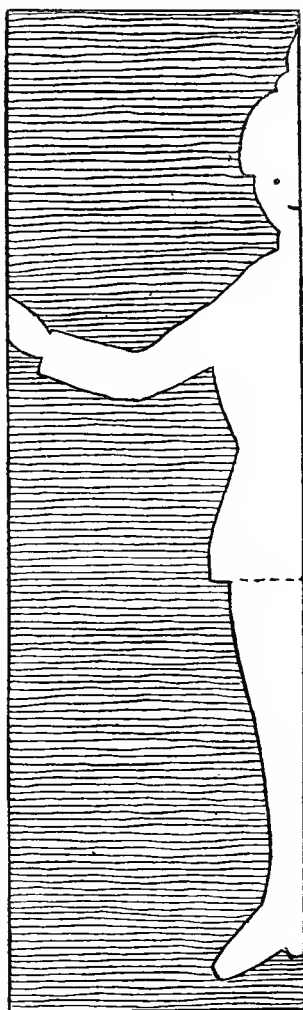
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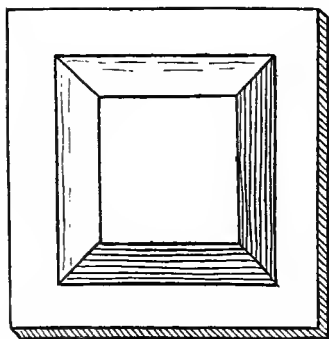
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11. SUPPLEMENTARY OR REVISION EXERCISES IN
MOULDING.

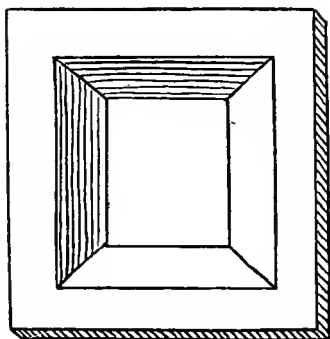
The boy of ten or eleven, as he moulds the plastic material, will remember with pleasure the figures with which he made acquaintance in his drawing-lesson. And he must learn to draw from the solid. Drawing and moulding react, as it were, on each other. By moulding or modelling in clay or plastilina the learner can show his capacity for seizing and presenting the thing seen. Drawing affords the same advantage, but differs from moulding in that it represents the thing seen as on a plane; whereas moulding reproduces it as it is.

Clay has this disadvantage that it quickly dries and crumbles. Work with this material once begun is not easily resumed after the lapse of a few days. We recommend that the tasks here suggested should be executed first in plastilina, and afterwards, when greater speed has been attained, in clay. Plastilina, wrapped in parchment-paper, will keep soft and mouldable for years. Objects made of it can readily be kneaded up again and the material used for the production of new shapes. Clay, as prepared by the potter, may be preserved for some little time if we guard it from the air by wrapping it closely in moist cloths and keeping it in a cool place. Care must be taken that it does not become mixed with any foreign matter, such as oil or varnish; otherwise it will be unfit for use and emit an offensive smell.

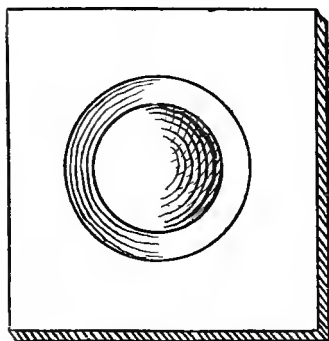
Modelling is best done, as far as is possible, with the fingers, particularly with the thumb and the forefinger. Nevertheless, the employment of a few tools is not excluded. Besides those represented in Figs. 146 and 147, it is advisable to procure the one shown in Fig. 380, as well as one resembling Fig. 146, but having a broader cutting surface. Required are also a knife, and a sponge for moistening the fingers and the tools. Children should be cautioned against using their tongues for this purpose.



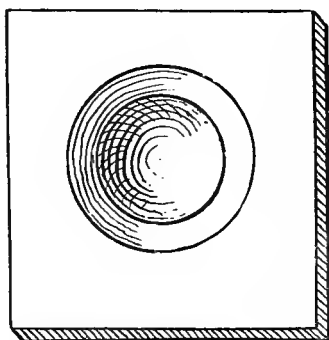
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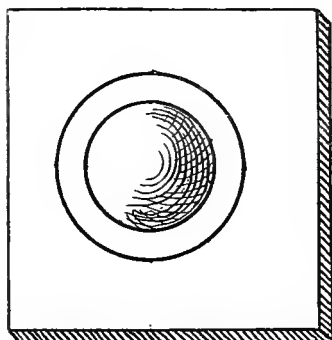
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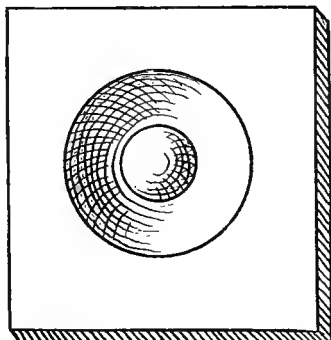
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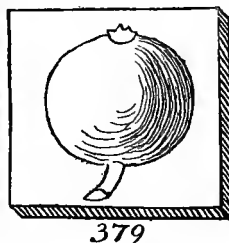
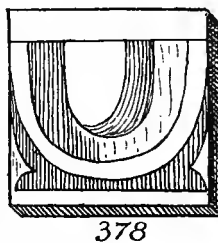
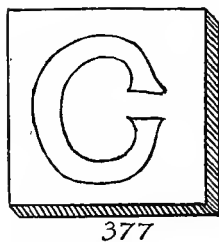
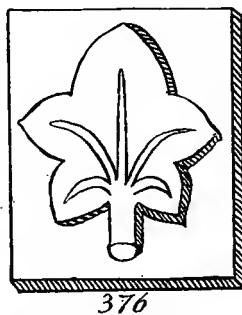
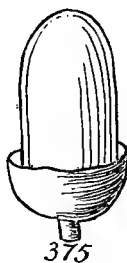
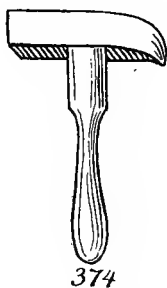
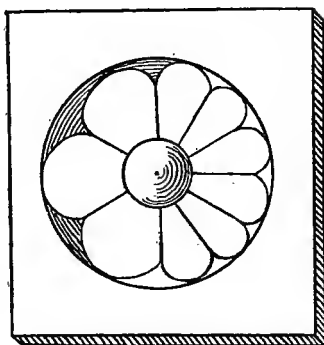
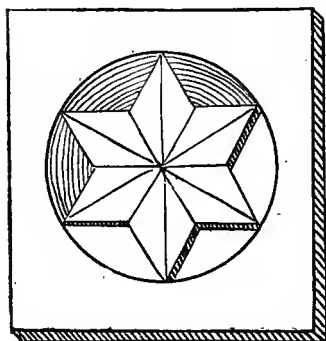
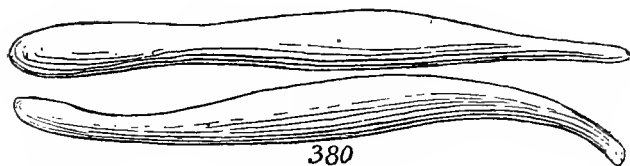
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370



371



On the figures which follow we may make the following remarks :—

If the forms are to be modelled in plastilina, the scale should be two or three times that of the drawing ; if in clay, four times. When a slab of clay has been fashioned between the strips on the modelling-board (see p. 58), we set out the drawing on the slab by means of ruler and compasses. The lines are traced with one of the points of the compasses. Then with the modelling tool (Fig. 146) we cut into the mass as required, and remove the superfluous clay or plastilina, but only so deep that one-third of the original thickness remains.

In modelling Figs. 368–371, as also in Figs. 375, 378, and 379, we employ especially the tool shown in Fig. 380. The star shape, Fig. 372, requires the tool Fig. 146, or a similar one with a broad, oblique edge. Other stars, pentagonal, heptagonal, or octagonal, may also be made. The modelling of the rosette (Fig. 373), of the egg-moulding (Fig. 378), and of the objects taken from life (*Lebensformen*), Fig. 374, etc., will need attention and some degree of practice. The figures are produced partly by cutting into the prepared slab, partly by building up upon it. In the latter case, as soon as the slab has been formed, the clay needed for the raised part of the design is laid on approximately in the shape required. The outline is then carefully traced and superfluous clay removed. Lastly, the full beauty of the design is brought out by means of the fingers and of modelling tools.

12. INTRODUCTION TO CHIP-CARVING.

A boy who has learned to handle knife, hammer, file, fret-saw, etc., will not find it difficult to ornament small objects made by himself, such as a stand for a glass, or the lid of a box. Chip-carving supplies a large number of patterns for such ornamental work, which, being confined to

straight lines, may be cut with one simple tool, indeed with the pocket-knife itself.

The exercises are based on elementary geometrical forms—the square, the triangle, the circle, the semicircle, etc. Exact measuring and drawing are the chief conditions of success.

Necessary tools are—ruler, measure with centimetre divisions, pair of compasses with one arm for pencil, lead-pencil, indiarubber, two files, knife or carving-tool, iron handscrew. The boards may be cut with a fret-saw. Beginning with a larger alderwood board, well planed on both sides, 8 to 10 mm. thick, we cut with the saw to the size required, and then dress carefully with the file.

The first step is to try the elementary cuts on a practice-board. It should be of alderwood, 10 cm. thick, 12 cm. broad, whilst the length will depend on the number of trials proposed. Perhaps 20 to 30 cm. will suffice. On this practice-board we draw a line 1 cm. from the edge, and set off on the line points 1 cm. distant from each other. Drawing parallels through these points, we obtain a number of squares. How these squares are used in the drawing of designs is shown in Figs. 390–406.

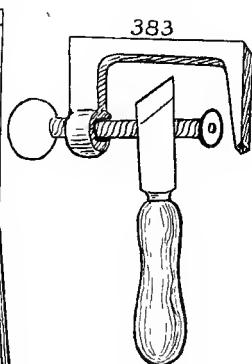
Exercise 1 (Fig. 390). The drawing set out, we begin to cut. Our object in this exercise is to remove the triangle acb . Holding the oblique-edged tool (Fig. 382 *a*) in the position shown in Fig. 386, we insert the point at c and cut first towards b , then towards a . The depth of the cut is at c 1 mm., but is gradually reduced, so that at a and b it is hardly appreciable. When these two cuts have been executed, we proceed to remove the triangle, the tool being now held as in Fig. 387. As the board is secured by a handscrew, both hands are free. Probably a beginner will be unable to remove the triangle with a single cut. If so, he must do it by pieces. Stronger boys will be able to obtain the result with a knife held as in Fig. 389; the shorter knife (Fig. 382 *b*) will then be more suitable. This



381.



382a.



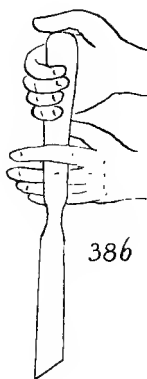
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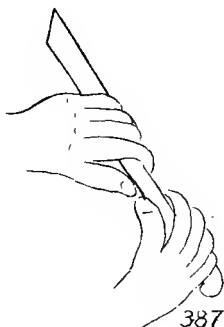
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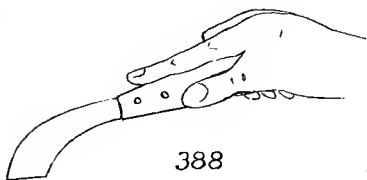
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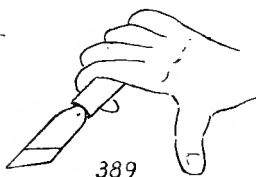
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method is to be recommended when the board cannot be secured to the table.

The knife shown in Fig. 388 may also be used for chip-carving. It is obvious that the shape of the knife will determine the position in which it is held. Our aim must be to cut according to the fibre of the wood and to obtain a clean surface.

Exercise 2 (Fig. 391). Here we have, in addition to the cuts in Exercise 1, the small triangular incisions shown in the plate at the middle points of the sides of the larger triangle.

Exercise 3 (Figs. 392 and 393). The triangles before left are in Fig. 392 removed, whilst those before removed are left intact. In Fig. 393 the triangles to be removed are determined by the diagonals of the squares.

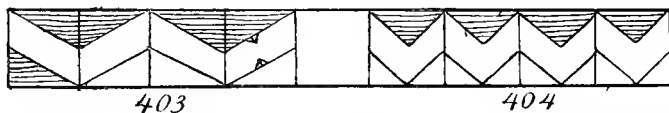
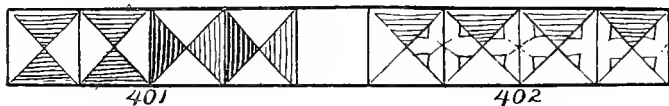
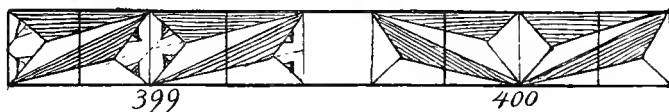
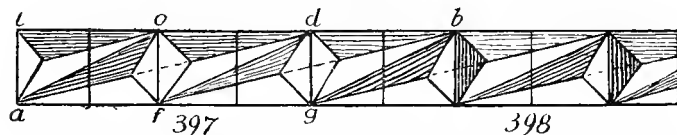
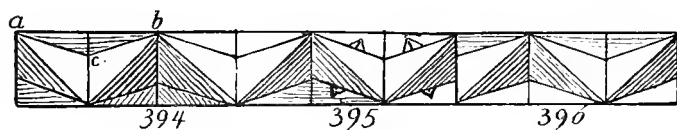
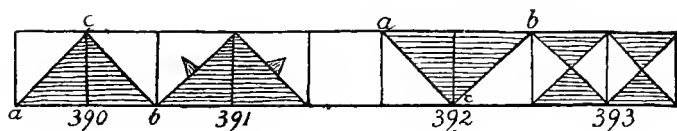
Exercises 4 to 6. Figs. 394–396 show how the drawing is set out and the cutting done. Observe that the lines *a c*, *c b*, etc., must be sharp and true.

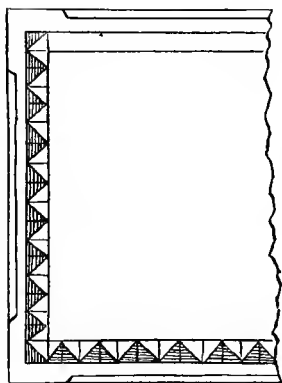
Exercises 7 and 8 are illustrated by Figs. 397 and 398.

The young chip-carver may now try his skill on a few objects of utility. In Figs. 407 and following, patterns for the purpose are given. Figs. 399–406 supply another series of patterns to be cut first on a practice-stick, then applied to the ornamentation of objects. It is not advisable to go further at the present stage.

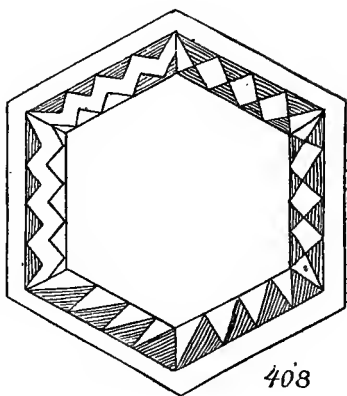
To give the objects made a more attractive appearance, they are covered when carved with walnut-stain. When dry they may be coated with prepared wax, the surface being brushed with a hard brush until a faint polish is obtained, or they may be varnished instead of waxed.

All materials for chip-carving, as also a series of progressive exercise boards and other useful articles, with a pattern printed thereon, ready for carving, may be obtained at a moderate price from the Publishers.

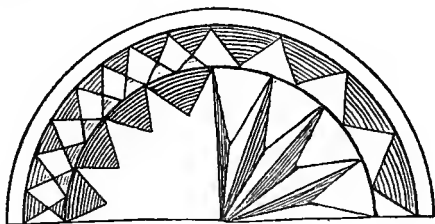




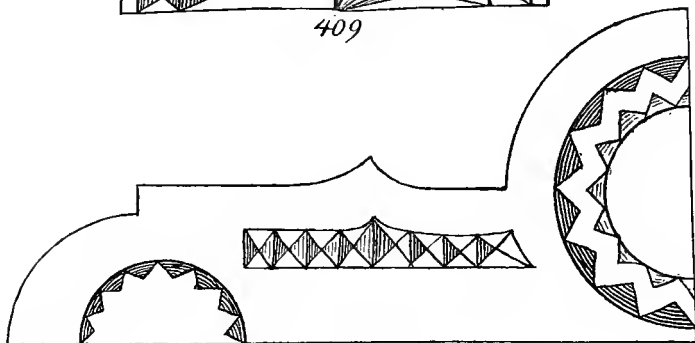
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CONCLUSION.

We have thus brought together a long series of tasks suitable for boys from their sixth to their eleventh year. When these have been mastered, the young workmen will find no difficulty in dealing with tougher material and more elaborate tools. This will especially be the case if they have learned to regard their work as real, to feel that they too must play their part in a working world.

A boy who has been taught to handle tools, who is able to make shafts or ladder for his toy cart, and repair the damage his playthings have sustained, can always occupy himself. He will never be disposed to idleness; he will know that what costs time, trouble, and skill to make must not be broken; he will begin to take pleasure in work for its own sake, finding how good it is to be busy and to employ his little hands in making things of use and beauty. The repeated efforts necessary will strengthen his will. Failure and success will alike operate in moulding his character. Manual work will cease to be accounted despicable, and those who live by it will be regarded with interest and sympathy. The object of education is to make good men and good citizens; here is a form of education which many wise men think a potent means of effecting that object.

Nor need the schoolmaster fear the introduction of these practical occupations into the school course. There is no rivalry between Manual Training and other kinds of instruction. On the contrary, whilst it must not be made subordinate to them to the detriment of its own methods, it can render them valuable assistance. What is taught in the classroom may be *veranschaulicht* in the workshop. If this course be adopted, the vague will become definite, the obscure clear. To the relation between our work and drawing several references have already been made. It is satisfactory to find that this relation is recognised by the Science and Art Department. The circular (Form 813)

dated June 5, 1890, lays down that Manual Instruction in elementary schools seeking the grant must be "connected with the instruction in drawing—that is to say, the work must be done from drawings to scale previously made *by the students.*" Geometry, arithmetic, physics, and local geography can all be illustrated in the workshop. To those who have introduced the last-named subject we particularly recommend the practice of modelling in clay or plastilina.

It is a common opinion that, however suitable Manual Training may be for elementary schools, it is superfluous in higher ones. That opinion may fitly be held by those who believe that the sole end proposed is to impart a certain dexterity of hand, useful for bread-winning—and by them alone. If our work has the moral and social value that its advocates claim for it, no school can afford to ignore it. To those who are in doubt we venture to make a practical suggestion. There is in many large schools, and there might easily be in all, a workshop, where teaching is given, usually by an artisan, in the routine of his craft. Substitute for the mechanical instruction of the workman a systematic course of educational handicraft, directed by a trained teacher. We can safely prophesy that the result will be a substantial gain from every possible point of view.

But it is not in the school alone that manual work may be carried on. Children have many friends. There are many who think with Whittier—

"A dreary place would be this earth
Were there no little people in it;
The song of life would lose its mirth
Were there no little ones to begin it."

All who delight in the young will find in the occupations we have proposed ample means of instructing and amusing their child companions. And the home will be all the brighter when, guided by their elders, the children ply their hands in work like this.

Doubtless our little book has its imperfections. Much might have been added, the explanations might have been fuller, the descriptions more minute. But we have always held that much verbal teaching is out of place in practical work. A few hints given, the plate examined and understood, the boy may set to work with good heart and hope of success. Moreover, the amount of help furnished must always depend on the teacher. Our notes will suffice for him, and he can, in case of need, follow the rule of doing the work before the boys, requiring them to copy it, and insisting on a detailed examination of all the parts. Nor will he allow them to stop at imitation, but will suggest variations, then leave his pupils to devise others.

In England our boys seldom suffer from want of exercise in the open air; they have as seldom learned the value of practical work. That those who have not may do so, we send forth these pages, with the valediction, *Ehre der Arbeit*.

“ Ehre der Arbeit—des Kopfes, der Hände,
Wo sie mit Eifer sich tummelt und regt!
Wo ist das Missgeschick, das nicht verschwände,
Wird sie mit freudigem Herzen gepflegt?

Ehret die Arbeit, sie würzet das Leben,
Kräftigt den Körper und adelt den Geist;
Seht, wie die Saaten sich golden erheben,
Und wie der Himmel den Segen verheisst.”
(*Graf von Bentheim.*)

“ Arm ist, wer ohne Wissens-Ernte
Dasteht im Lebenskreis.
Doch ärmer noch, wer das Erlernete
Nicht anzuwenden weiss.”
(*Dräxler-Manfred.*)

